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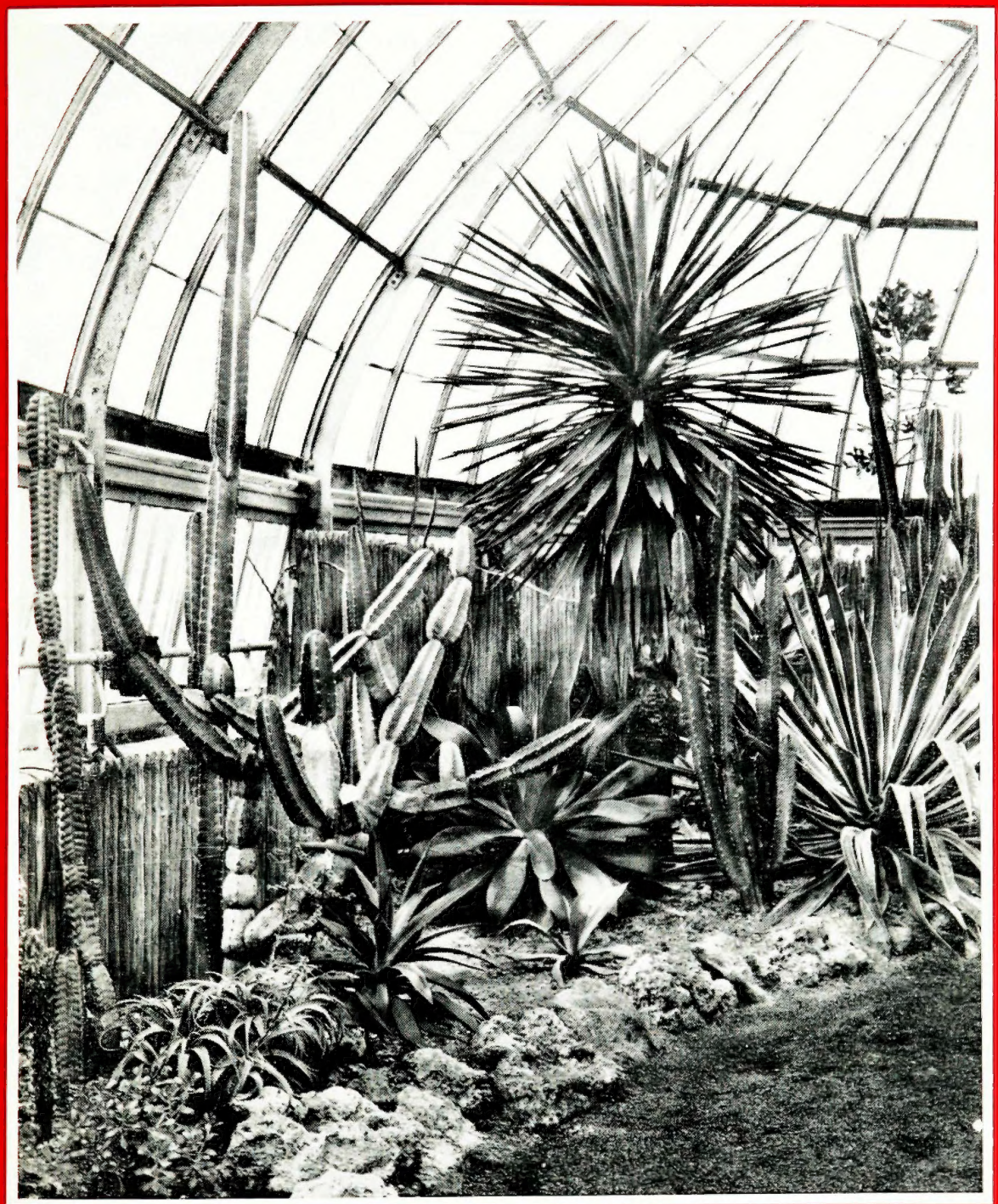
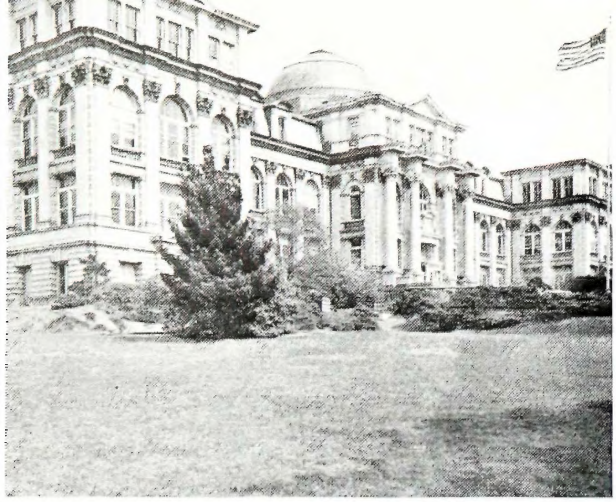


THE GARDEN JOURNAL

THE NEW YORK BOTANICAL GARDEN

Vol. 11, No. 1 January-February, 1961



THE GARDEN JOURNAL

THE NEW YORK BOTANICAL GARDEN

DOROTHY EBEL HANSELL
Editor

CALENDAR

February 28, 1961. Members' Evening of The New York Botanical Garden. See inside back cover for preliminary announcement.

March 4-12, 1961. International Flower Show, Coliseum, New York City: theme, "Gardens for Outdoor Living."

March 5-11, 1961. Philadelphia Flower Show, Trade and Convention Center: theme, "The Fifty States of the United States."

March 11-19, 1961. New England Spring Flower Show, Wonderland Park, Revere Beach, Massachusetts: theme, "Gardens of the Americas."

March 19-24, 1961. Colonial Williamsburg Garden Symposium, Williamsburg, Virginia: theme, "Keys to Garden Pleasure."

April 18-28, 1961. Third International Rock Garden Conference arranged jointly by Alpine Garden Society in London, with cooperation of the Royal Horticultural Society, and Scottish Rock Garden Club in Edinburgh, with cooperation of Regius Keeper, Royal Botanic Garden, Edinburgh.

April 22-29, 1961. Twenty-eighth annual Historic Garden Week in Virginia.

April 28-June 15, 1961. Fiorio del Mondo a Torino, Valentino Exhibition Palace and Grounds. For information, write Guiseppi Ratti, Via Pomea, 32, Turin, Italy.

May 2 and 9, 1961. City Gardens Club—annual showing of gardens and pent-houses terraces in New York, N. Y.

May 4, 1961. Spring Garden Tour to Bucks County, Pennsylvania, sponsored by The Volunteer Associates of The New York Botanical Garden.

May 12-14, 1961. International Rhododendron Conference in Portland, Oregon, under the auspices of the American Rhododendron Society.

April 27-May 7, 1962. Floralies, International Horticultural Exposition under auspices of Société d' Horticulture and Jardin Populaires de France in Valenciennes, France.

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CREDIT FOR ILLUSTRATIONS

We are indebted to the Display Committee, Mrs. Charles Burlingham, Mrs. Richard S. Meredith, Mrs. Donald B. Straus, for the selection of the front cover illustration—a scene in the cactus and succulent house of the Conservatory of The New York Botanical Garden, photo by E. N. Mitchell; pp. 2-5, W. C. Steere; p. 8, U.S. Forest Service; p. 9, National Park Service; pp. 12, 13, Gottscho-Schleisner; pp. 14, 15, 16, U.S.D.A. Soil Conservation Service; p. 17, Philadelphia Inquirer; p. 18, Biagio Pinto; pp. 19, 20, Ray R. Hirt; p. 23, Information Office, Consulate General of Japan; pp. 25, 26, Herman L. Becker; p. 30, E. N. Mitchell; p. 31, Geo. W. Park Seed Co.; p. 32, The Wayside Gardens Co.; p. 33, Esther Wheeler.

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BOTANICAL PROBLEMS IN ARCTIC AMERICA

By WILLIAM CAMPBELL STEERE

Dr. Steere is Director of The New York Botanical Garden. He delivered the following address as the retiring president of the Botanical Society of America at the annual meeting of the Society at Oklahoma State University, Stillwater, August 31, 1960.

I SELECTED THE TOPIC, "Botanical Problems in Arctic America," as being timely because of the recent admission of Alaska to the Union as the forty-ninth State, because of the large amount of publicity given to the activities of the International Geophysical Year in arctic and antarctic regions, and because of the increasing importance of our northern outposts in the military defense of this continent. Moreover, after eight field seasons in arctic and subarctic Canada, Alaska, and Lappland, I have developed some ideas and some questions that may well be of interest to a group of my botanical colleagues.

World War II brought about the sudden accessibility of the arctic. As a result, more botanists have visited arctic America in the last fifteen years than in all previous history put together. The reasons for this increased accessibility and the concomitant invasion of the arctic by botanists are several and diverse. Among them are the development of easier and faster methods of transportation such as bush planes on floats, wheels, or skis, and tracked vehicles such as weasels and snomobiles instead of dog-sleds; the establishment of new bases for radar sites, weather observations, oil exploration, and other purposes that may be used as research centers; the availability of research grants adequate for arctic exploration as well as other types of field support; and not necessarily least, the development of repellents effective against the hordes of unbelievably voracious mosquitoes and other biting insects.

My admiration for early botanists, geologists, and other scientists in arctic regions knows no bounds. The rigors of travel described by Linnaeus for his 1732 journey to arctic Lappland were no greater than those endured by botanists in Greenland and in northern Canada and Alaska up to two centuries later, assailed as they were by difficulties of travel, uncertainty of food supply, and plagues of insects. Dr. Wulff, a Swedish botanist, died in Greenland in 1917 of exposure and exhaustion.

Today, thanks to the availability of excellent logistic support and adequate transportation facilities, the major danger level has been reduced to indigestion from eating too much of one's own cooking. The dangers of falling from a cliff, crashing in a bush plane, starvation—or even vitamin deficiency, or being charged by an enraged bear or muskox are more than equally matched by the dangers of slipping in the bathtub at home or being run over while crossing the street.

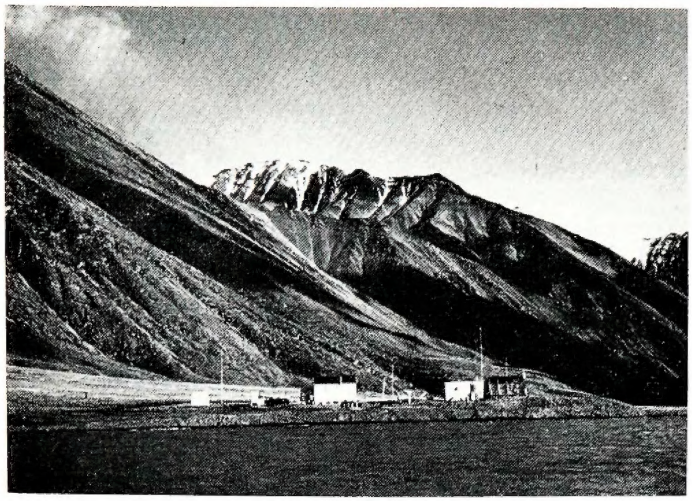
Arctic Europe has become especially easily available for scientific work. The railroad built across Lappland in 1903 to carry the rich ores from the great iron mines at Kiruna, at nearly 68° North Latitude, runs west to the Norwegian city of Narvik and east to the Baltic port of Lulea, with most of its length north of the Arctic Circle. Crossing the Arctic Circle in a comfortable train seemed almost ridiculously easy to me, after five field seasons in arctic Canada and Alaska. The contrast is exaggerated by the comfortable tourist hotels on the south shore of Lake Torneträsk and the ease with which one may go from one station to another in interesting areas on trains which run with the frequency of suburban commuters. On the North American continent no highways nor railroads cross the Arctic Circle, but many regularly scheduled airline flights do, and one also may easily charter a flight to any area off the regular airways where landing is possible. Tourtist hotels of sorts are available at Kotzebue, Barrow, and elsewhere north of the Arctic Circle.

The two physical characteristics of the American Arctic that most influence the distribution and behavior of plants are the permanently frozen ground and the long days during the growing season. The long winters and brief summers in themselves produce an effect that differs only in degree from that found in more temperate climates.

Permanently frozen ground, whether wet or dry, soil or rock, was termed "permafrost" by Simeon Muller in 1943 in his review of the extensive Russian studies of frozen ground in Siberia. Although long accepted as a fact of life in northern Canada and Alaska, permafrost became a critical factor to engineers engaged in the construction of airstrips and military bases during World War II. Its study has consequently progressed rapidly, with contributions to the solution of geological and biological problems as well as engineering. One botanist, William S. Benninghoff, has become a leading expert on permafrost. The term permafrost has been objected to on facetious grounds by some, and seriously by others; but because it is simple and obvious, it will continue to be widely used in non-technical circles. Professor Kirk Bryan has proposed to replace permafrost with "cryopedology" as the science of frozen ground, with a whole family of subordinate terms such as "cryoplanation," "congeliturbation," "pergelation," "congelifraction," for specific situations. These terms appear more and more frequently in technical papers.

In its northernmost range, permafrost may be extremely thick. It has been reported to extend two thousand feet downwards in Siberia and is well over one thousand feet thick in northernmost Alaska. At its southern boundary it becomes very thin and discontinues and eventually disappears. The origin of present-day permafrost dates from the beginning or from some later phase of the Pleistocene Ice Age, so that it may be as much as a million years old. Pleistocene-Age mammoths frozen into the permafrost have been found so abundantly in Siberia that they furnished for many years the largest single source of commercial ivory.

Permafrost develops where and when the annual mean temperature is from very slightly to very considerably below freezing. It is also influenced by plant cover which may



Lake Peters Research Station, at an altitude of twenty-eight hundred feet, in the eastern part of the Brooks Range, Alaska. This Station is administered by the Arctic Research Laboratory at Point Barrow.

furnish insulation and thereby retard thawing, by serving as a differential heat regulator. Conversely, the removal of the vegetation mat may upset the thermal regime and hasten thawing.

Permafrost must be discussed here because of its all-pervasive effects on the growth of arctic plants and its many correlations with arctic vegetation.

1. The maximum depth of superficial thaw each year, the so-called active layer, effectively limits or determines the plants that may grow there. If the active layer is as thin or shallow as three inches, it will support only sedges, grasses, and other fibrous-rooted plants without tap roots. Mosses, of course, with no roots flourish in abundance. Pine is ruled out in permafrost areas because of its deep tap root, whereas black spruce and larch do very well and extend considerably north of the Arctic Circle, where their limit is determined by climate and not by permafrost.

2. Permafrost provides a base impervious to drainage. Combined with the low evaporation rate, water tends to accumulate in spite of the extremely low precipitation. In flat areas more than half the land surfaces may be covered with lakes and ponds, and moderate slopes may become water-logged through moss-cover that obstructs drainage. One may be tempted to call this area the wettest desert in the world.

3. The frozen permafrost surface provides a lubricated base for down-hill movements of water-logged soil so that even very gentle slopes tend to be unstable and in motion, sometimes with a very disrupting effect on the vegetation.

4. Frost action keeps soil, gravel, and rock fragments in continual local movement, even when not sliding gradually downhill. This boiling, churning action, called congeliturbation, destroys the normal chronological stratification that we expect to find in soils. The pressure of freezing water causes the extrusion of materials from lower layers, much as milk is extruded from a bottle when frozen. Soil mounds are produced thereby, commonly a few feet high, but more rarely, under the influence of hydrostatic pressure, the mound may become a small hill or "pingo" twenty feet or more high.

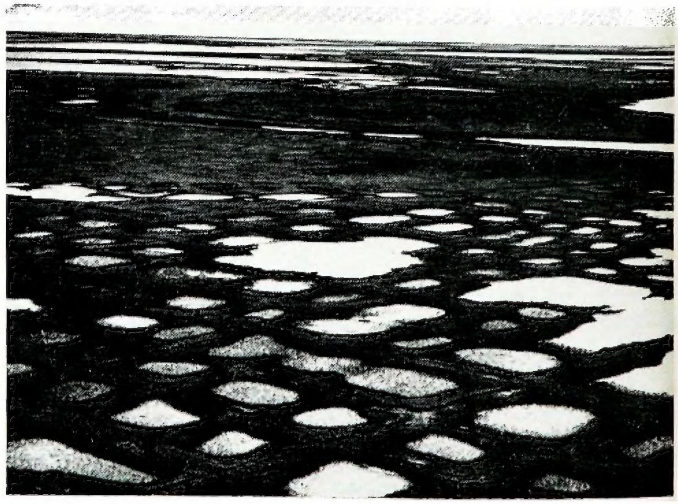
5. The boiling and churning of the ground has a second effect—the particles and materials of stony soils are sorted in circles or polygons on flat ground and in "stripes" and rock-streams on mountain sides. The smaller particles move inwards and the larger materials outwards. In wet soils the polygons are separated by vertical ice-wedges that exert greater and greater pressures on the enclosed soil as they grow in depth and thickness. The development of polygons produces a strong and conspicuous effect on the vegetation. The "patterned ground" that is produced by frost action is the most conspicuous single feature of arctic areas, and the presence of polygons always gives visible evidence of the existence of permafrost.

6. In a general way, permafrost has many other effects. If the superficial insulative layer of vegetation is removed the underlying permafrost will melt, as engineers learned to their sorrow in early experience with air-strips in Alaska. Where the vegetation had been bulldozed off and heat absorption exaggerated by the construction of black asphalt runways, the surface curved and buckled in waves. Relict ice blocks in the soil at the margin of the permafrost area can be a nuisance or even a hazard to agriculture when they melt, as has been seen at Fairbanks where large caverns have developed underground. Unfortunately, no plant indicator has been discovered for deep-lying permafrost, although some quantitative effect may eventually turn up with more intensive local study.

The construction of buildings on permafrost brings many engineering problems. Buildings even on pilings may transmit heat into the permafrost through the pilings with a consequent gradual settling as can be seen, for example, at the post office in Nome. Inhabitants of houses with insufficiently insulated floors may be surprised when suddenly the stove drops into a deep pool of mud. I have seen photographs of settlers' cabins in Siberia where downward melting reached an aquafer or water stratum under pressure, which then flooded the house and almost immediately froze.

The physiology of plants growing under permafrost conditions has not been well investigated and is not well known in this country. Some work has been done on plants growing and even flowering under snow, where temperatures may be above freezing and where little movement of air occurs. However, plants up to the size of trees that grow with their roots almost upon permanently frozen

"Patterned ground" in the tundra near Point Barrow. The polygons are formed by the growth of vertical ice wedges between them and are highly typical of permafrost or perennially frozen ground.



Mrs. Steere and a weasel—a light-weight, tracked vehicle that makes tundra travel feasible.

ground and with their tops in air whose temperature is well above freezing would seem to be in a state of perpetual crisis. The late Professor George Peirce of Stanford University once told me, with his usual humor, that it was obviously quite impossible for plants to do this. Since plants *do, how* they do it certainly needs careful study. Whether the physical chemistry of the roots and root-hairs of arctic plants differ in some way or to some degree from that of plants in temperate climates still remains to be determined. The limitation of all the subterranean activities of plants to the several inches of soil that thaw for a few weeks in summer presents a situation far different from the one most of us consider to be normal.

Long days during the growing season especially characterize the arctic—in fact, the Arctic Circle is demarcated by that latitude at which the sun does not set one night of each year. The higher the latitude, the more "nights" of sunshine, and even though the sun may set in subarctic areas, the nights are nevertheless light enough to support the growth of plants. The continuous light is the phenomenon first noted by the new visitor to arctic areas and is the condition most difficult to imagine until experienced. When one wakes up at 1:30 in the morning with the sun shining in his eyes, it is difficult to convince his physiological control system that day has *not* arrived and to relax and go back to sleep. The occupational hazard experienced by vigorous people in the arctic is insufficient sleep and overwork. Like people, plants must certainly respond otherwise in nature to continuous light than they do to the diurnal light rhythms of lower latitudes; yet little experimental work has been done in the arctic with the plants that grow there. Obviously, on the pragmatic evidence that arctic plants produce flowers and seeds, they are long-day plants. Short-day plants which may have existed under earlier and more temperate climates at the same latitudes have undoubtedly disappeared through inability to reproduce. The high incidence of apomixis, bulbil-formation, and other devices for vegetative propagation may reflect some adaptation to continuous light and the long-day requirements imposed thereby. The very common comparison of plants of high altitudes with those of high latitudes and the lumping of both categories as arctic-alpine plants tend to underemphasize or to conceal the great difference in day-length conditions, which in turn must be reflected by real differences in the physiology of the plants themselves.

Just as the Arctic Circle is circumscribed by that latitude at which the sun does not go below the horizon one night each year, so it also coincides with the latitude at which the sun does not rise above the horizon one day of the year. At higher latitudes many days have only twilight, and many others are short, indeed, exactly compensating in length for the opposite seasons. I should mention here the too common misconception that the arctic is the land of "six months of light and six months of darkness." I have heard serious botanists invoke Wegener's hypothesis of the wandering of the earth's poles, not because of the good reasons given by Wegener, but because they cannot honestly believe that the luxuriant forests that once reached the farthest northern lands and are represented now only by abundant fossils could have developed under six months of darkness. The presence of coal and abundant plant fossils in Antarctica raises the same question in a more aggravated form. Actually, of course, the darkness, twilight, and very short intervals of light would come during the dormant winter period when photosynthesis is suspended because of low temperatures. The present limit of trees northward on the various continents is determined by temperature and perhaps by other climatic factors, not by the shortness of day in winter. Forests of one type or another extend well north of the Arctic Circle in Scandinavia, in Siberia, and in North America. Both black spruce (*Picea mariana*) and larch (*Larix laricina*) reach the Arctic Ocean at the mouth of the Mackenzie River in northern Canada, but the tree-line abruptly retreats southward toward Hudson Bay and the Ungava Peninsula, paralleling very neatly the depressed isotherms of the mid-continent. In short, one does not have to invoke the wandering of the earth's poles, whether they wandered or not, to explain the presence of forests in polar areas in earlier geological eras, but only a somewhat warmer and more uniform climate.

...It would be impossible to discuss all the important and exciting botanical investigations called for in arctic regions. I shall mention a few general problems to point up the different dimensions and different parameters of botanical research in the arctic.

Although we are well acquainted with the reduced activity of microorganisms at lowered temperatures in the laboratory—and in the home refrigerator—we rarely see its effects in nature. At Barrow and in other arctic seaside villages, the Eskimos abandon everywhere the unused remains of seals, walrus, and whales that they have killed during the spring, adding much thereby to the picturesqueness of their habitat. However, instead of the galloping and richly odoriferous putrefaction inevitable in a warmer climate, decomposition takes place slowly under the low temperature and dry atmosphere, producing only a somewhat rancid but not wholly repulsive odor to which one's nose eventually adjusts. Beyond this, much remains to be known about the microorganisms of the soil, the water and the air in arctic regions, with especial reference to their metabolic activities.

A natural rock garden. *Agroseris* is a tiny relative of hawkweed and dandelion.

The fungi of arctic America have received very little attention from professional mycologists. Dr. Douglas Savile is one of the few mycologists who has worked in the Canadian Arctic Archipelago. Since agriculture is relatively unimportant in arctic regions, no economic incentive has precipitated a broad survey of even the parasitic fungi.

Large marine algae are less conspicuous in arctic seas than in even slightly more southerly waters, not because of temperature, but because of the scouring and grinding effect of floe ice on the shores. Although marine algae do occur at some depth and are washed up on the beaches after storms during the ice-free season, no intensive study of them has been made. The growth and productivity of marine plankton of the Arctic Ocean need study urgently, and such investigations would be well supported by several agencies. Fresh-water algae are abundant and occasionally form conspicuous "blooms" in tundra lakes and ponds. Dr. G. W. Prescott and his students have pioneered research on the fresh-water algae of arctic Alaska and on the dynamics of their ecology, but most northern areas have received little organized study by phycologists.

The bryophytes, because they form a rather conspicuous part of the terrestrial vegetation, have received serious attention through field studies in arctic America. Although the basic systematic inventory is reasonably complete, continuing problems of significance lie in the area of ecology, geographical distribution, cytology, and physiology of bryophytes, as well as their relation to permafrost.

Since earliest times the flowering plants have traditionally received more attention than other groups of plants, and nearly five hundred species have been found on the arctic slope of Alaska alone. The critical studies by Wiggins, Porsild, and Hultén on geographical distribution and by Löve on chromosome numbers have produced interesting and useful results. Löve has brought forth much evidence to support the hypothesis, proposed by Hagerup, that arctic plants show a greater degree of polyploidy and therefore possess a greater gene pool or genetic resource with which to resist the unfavorable environment. Cytological research on the growth of roots very close to permafrost and of meiosis in flowers that are subjected to daily temperatures below the freezing point should yield results of great interest.

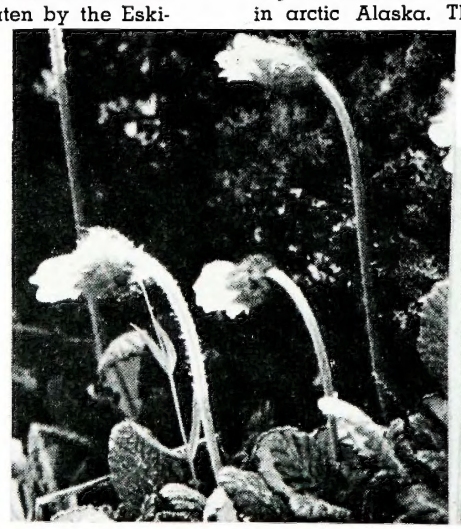
As implied throughout, the very physical conditions that make the arctic region what it is lead inevitably to ecological problems that need solutions. An excellent analysis of the vegetation dynamics in Alaska has been made by Dr. Max Britton, and we await with impatience the publication of the results of his sophisticated and cleverly instrumented studies of microenvironments and their microclimates at Point Barrow. The results of his ecological researches will be useful to workers in every other biological field.

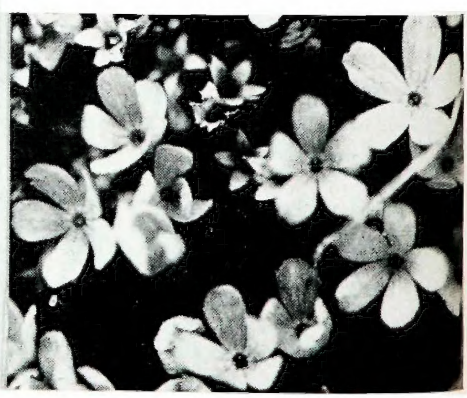
For genetic and biosystematic studies in such large and enormously complicated arctic groups as willows and loco weeds, among others, some sort of botanical garden must eventually be established in northern Canada or Alaska—or both. Genetical studies of species related to horticultural varieties will certainly turn up genes for hardiness and resistance as well as other desirable characteristics for use in plant-breeding programs. The genetics of fertility and sterility in arctic plants likewise need study, because of the alternative means of vegetative reproduction they display.

Although paleobotanical work in Alaska began early, this is still a highly promising field because of the abundance of fossils and the existence of forests in previous geological

Left. *Claytonia tuberosa*, a large flowered arctic relative of our own spring-beauty. In Alaska, the tubers are eaten by the Eskimos. Center. *Dryas drummondii*, a handsome yellow-flowered species of mountain avens.

Right. *Androsace ochotense*, a Siberian species that occurs rarely in arctic Alaska. The plants are densely tufted, with beautiful clear pink flowers. Photographs taken at Great Bear Lake, Northwest Territories, Canada.





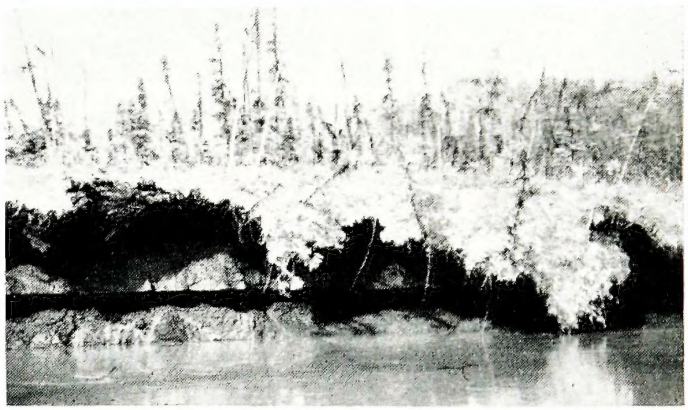
eras where only tundra now occurs. Microfossils, especially spores and pollen grains, have not received the attention in arctic areas that they deserve, except for the private, probably never-to-be-published works of oil companies; these use their data for the purpose of correlating geological horizons in exploration for oil which, incidentally, is surprisingly abundant in arctic Alaska. The use of carbon-14 techniques and other modern dating methods in the arctic will give data extremely helpful for undertanding the dimension of time during which the present types of vegetation have developed, as well as the cyclic changes in past climates.

At the moment, the most experimental and highly instrumented kinds of investigation of the behavior of plants under arctic conditions may have to be carried out in the well-equipped laboratories of more temperate regions. However, where natural conditions cannot be duplicated or even imitated, such experiments will eventually have to be made in the arctic, as facilities become available.

The Arctic Research Laboratory at Point Barrow, the northernmost part of the United States, offers many opportunities for research in arctic Alaska—in any appropriate field of science. Operating through the University of Alaska, the Geography Branch of the Office of Naval Research has for several years provided funds for the support of the Arctic Research Laboratory. Scientists who have research funds available to them from the Office of Naval Research, the National Science Foundation, the Arctic Institute of North America, or other responsible agencies, and whose research falls within the scope of interest and activity of the Arctic Research Laboratory, may apply for the privilege of working there. If space and other facilities permit his residence at the Laboratory, the scientist is provided with full logistic support, which means that he is furnished with food, lodging, heavy clothing, and is placed in the field as his plans require or else given laboratory space and equipment for his work in one of the seventeen laboratories. . . . At the moment, facilities are available and much scientific work is going on near Cape Thompson, between Kotzebue and Point Hope. Here the Atomic Energy Commission has established a base for extensive environmental studies before some proposed underground explosions of atomic materials are detonated in a year or two. . . . Other facilities for research in arctic Alaska may occasionally be found in the various Distant Early Warning or DEW Line sites along the arctic coast of Alaska and Canada, as well as in other quasi-military establishments. With a research grant adequate for chartering the service of a bush plane, a properly equipped investigator can reach nearly any area of arctic Alaska in which he wishes to work, quite independently of the agencies or bases just mentioned. However, in my opinion, one is well advised to work through the Arctic Research Laboratory or the Arctic Institute of North America, or both, because of the facilities and logistic services that these organizations can give, as well as their experience in cutting red tape.

In Canada, the Defense Research Northern Laboratory at Churchill, on the west coast of Hudson Bay, offers excellent facilities to investigators with research problems appropriate to the geographical locale, at the tension zone between the forest and the tundra. Although the latitude is only subarctic, the depressed isotherms of the mid-continent produce an arctic climate which in turn controls the limit of trees. Occasional highly qualified workers have been accommodated in weather stations and other establishments on the various islands of the Canadian Arctic Archipelago, even as far north as Alert, on Ellesmere Island, at a latitude of 82° Again, with adequate funds for transportation, sufficient equipment, and the essential approval of the proper authorities, a serious worker can place himself in any geographical spot whose circumstances are more appropriate to the requirements of his work.

It may be appropriate to note here that the University of Copenhagen's Biological Laboratory on Disko Island, on the west coast of Greenland, is probably the oldest arctic scientific station in existence. Admittance to the Laboratory and permission to work anywhere in Greenland are given by a central commission on arctic research, at the University of Copenhagen. Moreover, workers must be able to qualify for a Danish visa and for official permission to visit Greenland. Occasional researchers with special needs have received permission to center their investigations at U. S. installations, at Sondrestromfjord, at Thule, and at other bases in Greenland. .



Frozen ground along the Kuskokwim River near McGrath, Alaska. Floodwaters have melted away the permafrost from under the thin rug-like mat of moss and roots to which all surface life of plants and animals is restricted.

I am obliged to add somewhat parenthetically that the Russians have far more arctic scientific research and experimental bases and stations than America does, scattered through the vast reaches of the Siberian arctic and the arctic islands north of the Eurasian continent. Whether scientists from outside the Iron Curtain are welcome or even tolerated in these laboratories, I do not know. My only advice to anyone who is resourceful enough to arrange an invitation to work in one of the arctic research stations in the U.S.S.R. is that he insist on a round-trip ticket.

In arctic regions every field of botany, every plant science—and every science—present innumerable problems that demand investigation. These problems are challenging and timely, and many are now of real importance to our national welfare. Moreover, because of the novel environmental conditions and the relatively small amount of previous work, investigations of arctic problems are very apt to be unusually rewarding and productive. As I review the foregoing remarks, it occurs to me that I might have selected, with equal suitability, the title "Botanical Opportunities in Arctic America."

CONCEPTS OF CONSERVATION

"SCIENCE SO FAR has devoted itself to many fields, but up to the present has never concerned itself with the preservation of simple beauty and landscapes for the creation of childhood memories. Artists and illustrators continue drawing colorful pastoral scenes rich in flowers and animals as decorations for children's stories. Psychologists have from time to time condemned fairy stories for the illusions and complexes that they build up in the minds of children. What complications then will arise, or are arising now for that matter, from the use of peaceful countrysides and profuse floras and faunas in the child's book? Certainly there is no greater illusion for the city child than the idea that such scenes are enduring, well-taken-care-of parts of the world in which he is growing up. . . .

"City children have no concept of wildness, of the rhythm of natural events, of the significance of non-human forms of life, of the inter-relationships of living things and the land. At the same time present and future generations are faced with the very difficult problems of dealing sensibly with river and stream control, erosion control, human nutrition, and prevention of disease, both physical and mental, resulting from abnormal developments in society. Even a brief consideration of these problems demonstrates the need for a public familiar with the land and conscious of the existence of natural laws. If, as children, adults have had contact with the beauty, peace, organization and the thrill of wild plants and animals in their natural habitats, it will be that much simpler for them to understand problems involving man and his environment. . . .

"Highways radiating from the city gradually force wild places into the distance, and the quest of country lanes is forgotten in the thrill of speed. . . .

"...I often wonder where my child can go to learn what this earth was like before he was born. . . ." Alfred G. Etter, Associate Professor in the Department of Fisheries and Wildlife, Michigan State University, in *The Land.*

Mindful of the scene of his youth where he spent many hours enjoying the natural beauty as he tramped through the wooded glen, Hugh Taylor Birch deeded nine hundred and twenty acres to Antioch College, to be known as the Glen Helen Memorial in memory of his daughter Helen. These acres are "an outstanding living museum of primeval America," their geology and flora unique in Ohio and neighboring states, and on them Antioch College is conducting an excellent program in conservation education.

When Alton A. Lindsay of Purdue University and an officer of the Ecological Society of America, learned that Glen Helen was theatened by a wide highway, he said, "...this country could soon find itself with a dense venous network of super highways, but nothing left outdoors worth traveling them to see." Fortunately, the citizens of Ohio and elsewhere raised sufficiently strong protests, the highway has been relocated, and the youth of today and tomorrow in Ohio and adjacent states will have Glen Helen in which to enjoy cliffs, streams, and springs; trees, wild flowers, birds, fish, and game.

In the words of Theodore Roosevelt, "The nation behaves well if it treats the natural resources as assets which it must turn over to the next generation increased and not impaired in value. Conservation means development as much as it does protection." Conservation means not wasting, but using wisely renewable natural resources—forests, water, soil, plants, and wildlife—"for the greatest good of the greatest number for the longest time." It is necessary not only to provide places of natural beauty for the oncoming generations, but to instill in them an appreciation of such beauty, to instruct them in ways of conserving and protecting the nation's natural resources, to impress upon them that man's continued existence depends upon the conservation of the soil, forests, minerals, water.

In the Watchung Reservation of Union County, New Jersey, an exceptional program in conservation education is being conducted by Dr. H. N. Moldenke, the Director of its Trailside Museum. Dr. Moldenke was formerly a member of the staff of The New York Botanical Garden. The Trailside Museum has exhibits of plant and animal life, insects, soils, stones, minerals, shells, and so on, some of them very attractively staged, all well labelled. Informative literature is available, and instructive lectures are given on Sunday afternoons. In addition, Dr. Moldenke has prepared mimeographed material on worthwhile conservation projects that can be carried out by Boy and Girl Scouts and other youth groups.

The people of Union County, adults as well as youth, are fortunate in having the Trailside Museum and the Watchung Reservation, because they live in a region that has been changed from rural to urban within the past twenty years. The exploding population and the urbanization of many regions throughout the United States makes it vitally important that certain areas be retained in their natural state, else plant and animal life will be dissipated.

In the *Bulletin of the Garden Club of America* (Vol. 48. No. 3), Richard Pough wrote, "Land is a unique commodity. From it springs most of what we need to live and enjoy life. Although indestructible, it is non-expandable. Thus as our population grows through the centuries ahead, there will be a greater and greater need for lands so that all those with outdoor interests can share. Nothing we own is quite as precious as land, and nothing we can do can have as great an impact for good or evil on coming generations as the disposition we make of the land we own."

As far back as the 1960's, one hundred years ago, some people began to manifest concern about the waste of our forests and the disposition of public lands. Land for the first state park was set aside in 1865; for the first national park in 1872. Articles began to appear in newspapers and magazines. Charles Sprague Sargent, the first director of the Arnold Arboretum, wrote an article on "The Protection of our Forests" in *North American Review* in 1882. Charles W. Eliot of Harvard University was another who wrote several articles on the subject at the turn of the century.

In 1891 the first forest reserves were withdrawn from public domain; six years later provision was made for their administration; and in 1898 Gifford Pinchot was appointed head of the Federal Division of Forestry.

Although more voices were lifted in alarm in the early 1900s, most people looked upon the forests as "something to be cut down and used for lumber or fire wood" when Theodore Roosevelt became President of the United States.

He called the First National Congress on Forestry in 1905 and the first conference of governors for an inventory of the nation's natural resources in 1908. It was Pinchot who proposed a national conservation program; and Roosevelt, with such dedicated men as Pinchot and Frederick H. Newell as his aides, succeeded in convincing some of the country's leading citizens that the conservation of its forest resources was important to the national economy and that their management required a sound program under trained leaders.

During the past half-century many men have rendered services of inestimable value to the conservation and preservation of the nation's natural resources, but certain individuals stand out prominently. Pinchot and Newell in forest conservation; Dr. Hugh H. Bennett and Dr. W. C. Lowdermilk in soil conservation; Stephen T. Mather and Horace M. Albright in the National Park Service; Jay N. Darling and Ira N. Gabrielson in wildlife management; and Dr. Paul B. Sears in conservation education.

Organized groups have exerted tremendous influence and contributed generously to conservation projects—to the establishment of memorial gardens and sanctuaries, to the restoration of places of historical, horticultural, and botanical significance, to the enlargement of parks, to the preservation of national monuments and natural areas. The Garden Club of America, the state federations of garden clubs, The Nature Conservancy, the National Audubon Society, Wildflower Preservation Society of America, Nature Association, Wildlife Management Institute, Save the Redwoods League, Inc., and Resources for the Future, Inc., are only a few of the numerous organizations that are actively engaged, in one way or another, in conservation programs.

The National Audubon Society, at its annual meeting in New York City in October 1960, was informed by Dr. James T. McBrown of the U. S. Fish and Wildlife Service that the only hope of preserving water fowl was an accelerated program to purchase wetlands before they were all lost to drainage and flood control; otherwise water fowl will be relegated to the care of zoos in cities.

At the meeting of the Torrey Botanical Club on November 1, 1960, Dr. Richard E. Goodwin, Professor of Botany at Connecticut College and former president (1956-58) of The Nature Conservancy, spoke on the urgent need to preserve the vanishing natural areas of this country. This non-profit membership organization is "dedicated to the preservation, in their natural state, of biologically and geologically significant examples of the American landscape," of setting aside and protecting forests, salt marshes, sand dunes, sphagnum bogs, pine barrens, deserts, western prairies, arctic alpines, and southern savannas from disturbance by man. Many of the fascinating biotic communities — communities of plants and animals living in integrated units — have disappeared. The tall beautiful grasses of the plains and prairies have been replaced by wheat and corn; marshes have been drained and put under cultivation; the sand dunes have been removed and converted into shore resorts.

The Nature Conservancy, incorporated in 1950, was an outgrowth of a study made by the Ecological Society of America. Its first piece of real estate was acquired in 1954. Today it owns and manages forty preserves. It aids others legally and financially, as, for example, Mettler's Woods near New Brunswick, New Jersey, and the Mianus River Gorge in Westchester County, New York, near the Connecticut line. In these natural areas people find mental and physical refreshment; and botanists, ecologists, geologists, and other scientists are afforded the opportunity to study vegetation and wildlife in their natural environments. A number of these natural areas are near educational facilities —accessible to secondary schools as well as to institutions of higher learning, for The Nature Conservancy recognizes that "unless the school children of today are imbued with an appreciation of nature, they will not be ready to provide the sustaining influence required for the continued protection of our country's remaining natural resources."

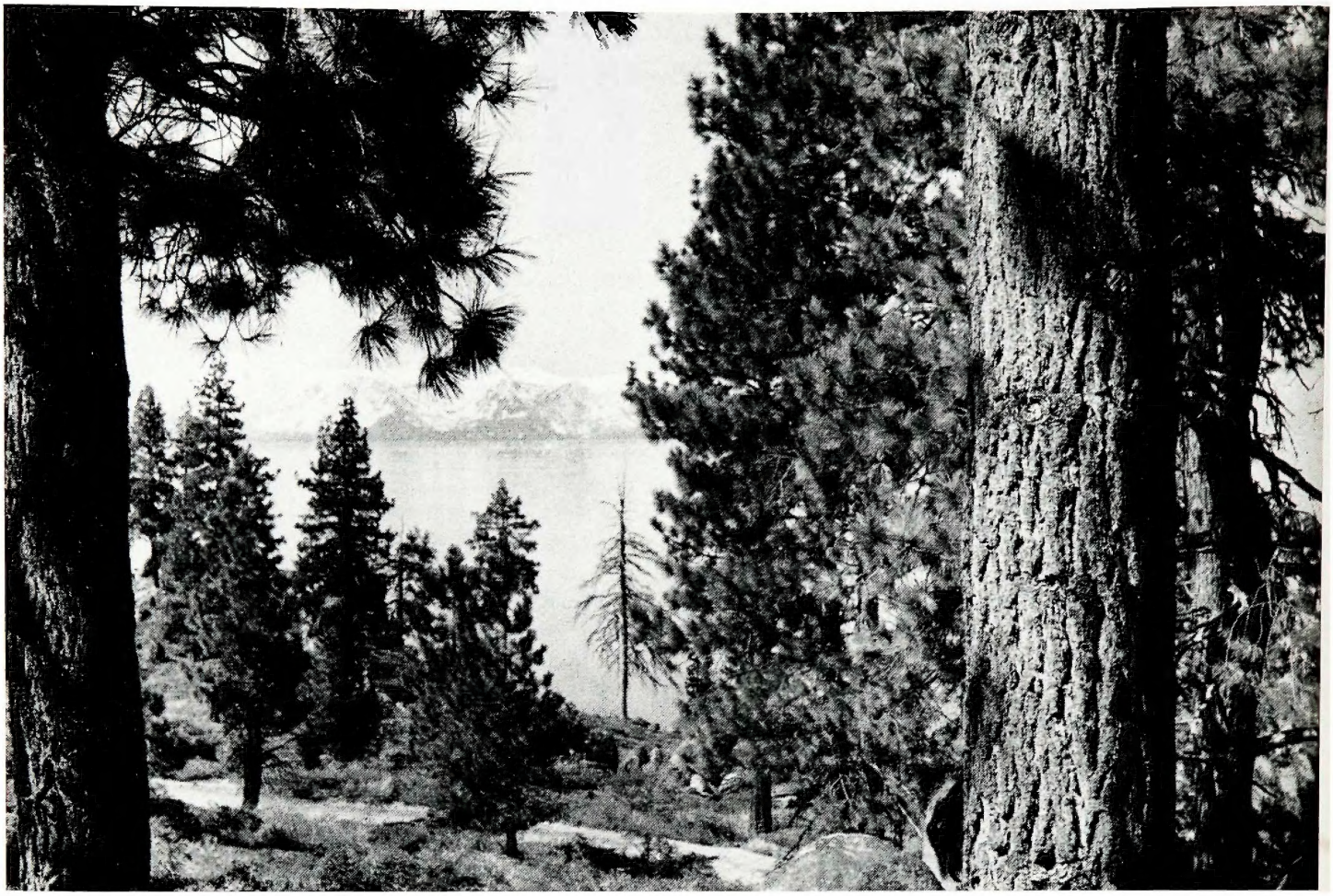
The need for conservation has been emphasized so extensively that it would seem unnecessary to caution Americans to remain alert to encroachments upon the nation's natural resources. But as Paul B. Sears wrote in *The Garden Journal* (Vol. 3: p. 2. 1953) "There is unremitting pressure from those who would turn a nimble dollar by picking the landscape to the bare bones." Not all the blame, however, for defacing or destroying natural resources can be laid upon private individuals and commercial firms. There are times when one government agency is bent on invading park land or a natural area and another government agency is striving to resist such encroachment and provide protection. Within the past few years residents of several counties in New Jersey have become familiar with such predicaments. They have been confronted with proposals to flood farmlands in Warren and Hunterdon Counties for a new reservoir; to cut through Watchung Reservation for a limited-access freeway; to drain the Great Swamp, with its unique plant and animal life, in Morris County, for a jet airport. All required, so the proponents claim, for the "March of Progress."

Man's dependence on natural resources is more than material. He travels afar to the wilderness areas, to the national parks and monuments; he visits the smaller green pastures nearer his home, the sanctuaries and public gardens, for spiritual inspiration. "Conservation goes far deeper than the matter of bread and butter," quoting Dr. Sears again. "It involves the whole concept of freedom, dignity, and the American people."

Conservation Extends to Birds

THERE ARE THOSE who complain about birds—that they are a nuisance, that they cause damage from time to time. Some birds, it is true, have proved troublesome. For several years starlings devoured the berries on trees in holly orchards in the Northwest and ruined the crop. Generally, however, birds are a valuable asset to farmer and gardener, as well as a pleasure to observe and to hear. They feed on many kinds of insects and weed seeds. The U. S. Department of Agriculture calculated some years ago that the value of birds in controlling insect pests is more than three

(Continued on page 10)



Lake Tahoe, south and looking southwest from the Nevada side at a point near Zephir Cove.

STEPHEN G. MATHER, FATHER OF THE NATIONAL PARKS

By CONRAD L. WIRTH

Mr. Wirth, Director of the National Park Service, delivered an address at the dedication of the Stephen Tying Mather High School in Chicago, Illinois, on May 17, 1960. Excerpts of his address follow.

NEARLY FIFTY YEARS AGO, when the ideals of conservationists — and conservationists themselves — were often the objects of ridicule by uninformed and short-sighted people, a very fortunate meeting occurred in the wilderness country of California. The meeting was fortunate because of it an idea was born, an idea that was to develop, flourish, and eventually result in the National Park System as we know it today.

Ideas presumably do not exist apart from people, and this idea was planted in the mind and heart of a highly successful business man, Stephen Tyng Mather... What his concern for the reservations of wilderness land in the public domain—the National Parks—would come to mean for the nation is but one chapter in the story of a great man.

It is this chapter of Mather's life that I propose to sketch for you, for he was destined to be the father, developer, and first director of the National Park Service.

The idea that "bit" Mather nearly half a century ago resulted from a chance meeting with John Muir, the great naturalist, in the Kern River Canyon wilderness. Mather, a spare-time mountain climber and member of the Sierra Club, was not unaware of the joys and benefits of the "great outdoors" and the already current advice to "See America first." It took the venerable "John of the Mountains," however, to implant in Mather the conviction that he, Stephen Mather, had a personal responsibility, an urgent and unavoidable necessity, to do something for the protection and preservation of the great natural, scenic, and historical heritage that he and all Americans possessed in the areas that were reserved or were yet to be set aside as National Parks.

John Muir's warning of what some of the lumber, mining, and power barons were doing to exploit and ruin the wilderness country, so greatly needed in the very near future as retreats from the dynamic, fast-growing, industrial civilization, touched Mather in a sensitive spot.

Mather, himself a mining king, resolved... that he had to give something back to the nation which had done so much for him. His opportunity lay only two years ahead...

There were a number of National Parks and National Monuments, each reserved by a separate Act of Congress, the day Mather talked to John Muir, and among these Mather dearly loved Yosemite Park.

Three departments of the Federal Government shared administrative responsibilities for these areas—the De-

partments of War, Agriculture, and Interior. Nowhere in Washington was there a single office dedicated to the overall supervision, protection, and development of National Parks.

Yellowstone had been set aside by Congress in 1872 and Yosemite in 1890. Both were administered by the Army for the Secretary of the Interior. Often it seemed that only those who hoped to benefit personally from the resources of these great reserves appeared fully aware of the existence of the National Parks. Few Americans traveled to them until the coming of the automobile, and then literally thousands of cars packed the trails and dirt roads into the Parks. The choking dust seemed almost impenetrable, but Americans were determined to see their Parks. The influx of humanity became a threat in itself to the preservation of the wonders and peace of the National Parks.

As an observer of the problems and already burning with the awareness of personal responsibility, Mather wrote a letter to Washington to express his concern on how these areas were being neglected. The letter received a quick and pointed answer from Secretary of the Interior Franklin K. Lane, who had known Mather thirty years before in California: "Dear Steve. If you don't like the way the National Parks are being run, come on down to Washington and run them yourself."

Mather . . . went to Washington and before he left he agreed to give one year to the National Parks. On January 21, 1915, he was sworn in as Assistant to the Secretary of the Interior for the purpose of creating a National Park Service.

As an educational move, Mather first organized tours of the Parks and the wilderness reserves of the West which he knew. Paying for the expenses in large part out of his own pocket, he personally led groups of industrialists, conservation-minded publishers, philanthropists, and other influential persons on inspection trips into the Sierras. The mountain trips provided dozens of prominent men experiences they would never forget. Six feet one and handsome, even in middle age, Mather was a man of great physical vitality and vigor. Coming upon icy waterfalls from snow-covered watersheds, Mather would leap from his horse, throw off his clothes, and cavort in the "free-shower"—and this he did four or more times a day. Up early in the morning, he would awaken his colleagues to the tune of air whistling out of their air-mattresses and the jarring tom-tom of the camp's cooking pots.

That these field experiences paid off is attested by the fantastically loyal, life-long friendships he made and by the support for National Parks he earned from such influential persons as Gilbert Grosvenor of the National Geographic Society.

Mather had no doubt that he could "sell" Congress on the idea of a National Park Service. How to finance it was another problem. Before Congress could vote funds, there would have to be a public clamor for monetary support of the park idea. Here, again, as on many occasions to come, Mather put up his own money for the job. He also bought the Tioga Road, a privately-owned access road to Yosemite, and tried to give it to the Government. Gifts to the Government, he found, were as popular as gifts to the private accounts of a Federal official—they were thoroughly suspect, and Congress had to pass on the propriety of each gift. After some difficulty, he secured the passage of a law to permit the Secretary of the Interior to accept donations of money or land for park purposes.

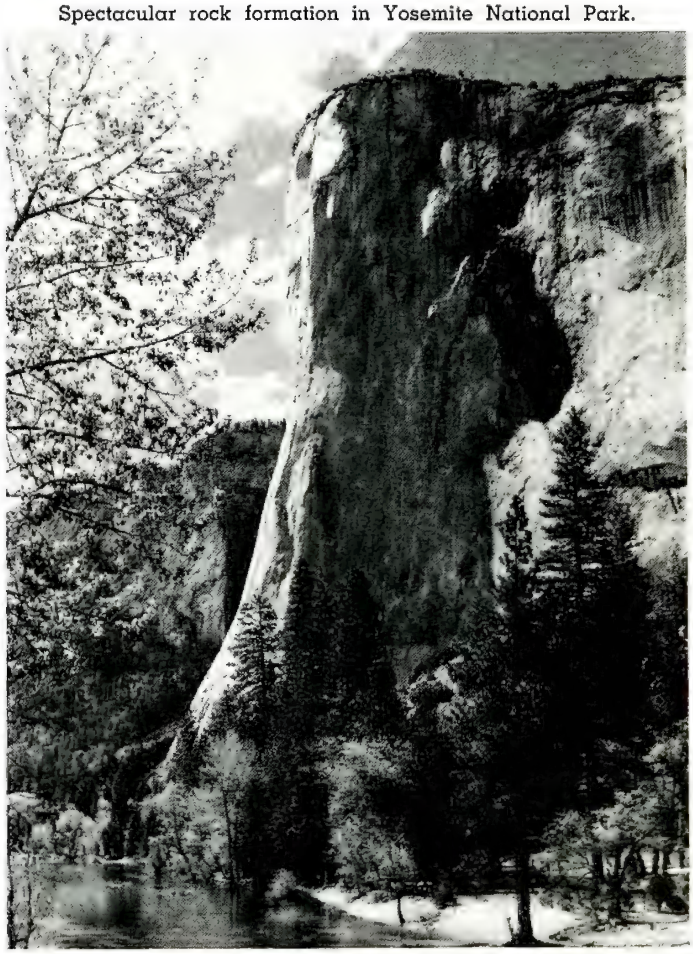
In due course, the Park Service came into being with the signing of the National Park Service Act of August 25, 1916.

Mather had the quality of attracting and enlisting others in his projects—he not only obtained their support, he quickened their enthusiasm. Most remarkable was his enlistment of businessmen in finding the solution to many park problems. He worked out fair contracts for concessioners, which, in his own words, were "...consistent with satisfactory service to the public and a fair return on capital invested, irregularity of seasons, and the otherwise generally hazardous nature of the investment being considered."

In persuading one investor to build a hotel in Yosemite Valley, a sober businessman who drew back in fear of empty rooms and little business, Mather exclaimed, "Look at those cars! There must be close to two hundred. Where's your imagination? Some day there'll be a thousand." Today, hundreds of thousands of cars bring well over a million visitors each year to Yosemite.

In the acceptance of gifts, Mather made possible the preservation of giant sequoias and irreplaceable values in historical and scenic areas. In addition to thousands of small gifts from dedicated people in all walks of life, the National Park Service has been the recipient of substantial portions or whole areas for new parks and of funds for research and development from the National Geographic

Spectacular rock formation in Yosemite National Park.



Society and from the Rockefeller and Mellon families.

With his genius for organization, Mather set the pattern for the National Park Service as it is today—a career service with unusual esprit de corps and an agency perennially above partisan politics.

When he took charge, Mather had under his wing fourteen National Parks and eighteen National Monuments, with a combined area of 7,426 square miles and $254,000 to maintain them. Visitors totaled 335,000. Twelve years later, when he retired, Stephen Mather left a legacy of twenty National Parks and thirty-two National Monuments. These had a combined area of nearly sixteen thousand square miles. Expenditures totaled nearly five million in cash, and authority for the obligation of an additional four millions made up a park program of nine millions. The count of visitors that year was over three millions.

Today, there are twenty-nine National Parks and one hundred and fifty-six National Monuments, battlefields, memorials, and other sites in the System. The combined areas of the Park System is 39,057 square miles; the budget calls for a program of $83,060,000; and the public-use count was 63,000,000 people in 1959.

Ideologically, we still stand in Mather's shadow. It was not Mather's goal to add on to and build up a public-land colossus. He believed that only those areas of truly great scenic, scientific, or historical value and unquestioned national significance should be added to the Park System. We have not yet reached the optimum in preserving for the people what should rightly be theirs.

We are today, as we were in Mather's day—and many park men hail from that golden era—dedicated to making "accessible for a multitude of Americans their heritage of snow-capped mountains, glaciers and streams and falls, of stately forests and quiet meadows."

It was also Mather's genius to recognize the potential worth of the nature walks and guide service of Mr. and Mrs. C. M. Goethe at Lake Tahoe, and just forty years ago this summer [1960], to bring the Goethes and their concept of "indoctrinating young people in the beauty and wonders of their native land" to Yosemite. This interpretive program is now seen in the uniformed ranger naturalists, historians, and archeologists guiding visitors in the National Parks. It is this program that has made the National Parks the world's greatest outdoor school, a fascinating and unique educational institution.

To some men monolithic memorials of granite are raised, and to others long eulogies of unstinted praise are woven. Few men have had the honor, as does Stephen Tyng Mather, of having as his memorial that which belongs to all Americans—the National Park System.

CONSERVATION (from page 7)

hundred and fifty million dollars annually.

A house wren, so it is said, feeds five hundred small worms and spiders to her young during a summer afternoon. This seems a fantastic statement; yet having watched a busy wren flying to and fro from the little wren house in my garden to feed her brood, I can believe it.

If you would enjoy the help of birds in keeping down the insects and weeds in your garden, then you should encourage them by providing the trees and shrubs that they like for shelter and food.

Mrs. Avery Rockefeller prepared a very helpful and attractive leaflet, *Berried Treasure for Your Birds,* for the Conservation Committee of the Garden Club of America. This has had wide distribution. Among the recommended "Plant Materials for Sanctuary" listed in the leaflet are the Japanese white pine (*Pinus parviflora*), an important source of food as well as a place for nesting sites, the flowering dogwood (*Cornus florida*), and the high-bush blueberry (*Vaccinium spp*). The blue-jay, chickadee, gold finch and purple finch, flicker, robin, song sparrow, and thrush eagerly seek the berries of the dogwood and the high-bush blueberry. Some years we have little time in which to enjoy their beauty, so quickly do the birds find these berries. Margaret McKinney in *Birds in the Garden* states that ninety-three kinds of birds like them.

Only two viburnums, *V. opulus* and *V. sieboldii,* are listed under "Additional Suggested Materials" in *Berried Treasure for Your Garden;* however it is stated that the "many varieties make this family first choice for birds and gardeners." I have found that birds like the fruits of several of the native species, *V. acerifolium, V. cassinoides, V. dentatum, V. lentago,* and *V. prunifolium.*

The bayberry (*Myrica pensylvanica*) is another native shrub popular with almost one hundred different kinds of birds because of its waxy grey fruit. These include the bluebird, catbird, chickadee, brown thrasher, downy woodpecker, myrtle warbler, and tree swallow. The snowberry and the coralberry (*Symphoricarpos albus* and *S. orbiculatus*) furnish food for more than thirty species of birds. The beauty-berry (either *Callicarpa americana* or the Japanese *C. dichotoma,* usually listed in catalogs as *C. purpurea*) is relished by the cardinal and the catbird. The cardinal goes after beetles, cutworms, leaf hoppers, and plant lice, while the catbird rids the garden of caterpillars, crickets, and locusts. The cardinal departs promptly when we start to work in the garden. We enjoy his company at a distance —from the windows of our home early in the morning and again late in the afternoon. The catbird is much more friendly. He follows us from one part of the garden to another as we work, or sits on the branch of a nearby tree or shrub, holding conversation with a member of the family who is able to imitate his call.

The hawthorns, particularly *Crataegus oxyacantha, C. arnoldiana,* and *C. crusgalli,* and the flowering crabs, such as *Malus floribunda, M. sargentii,* and *M. sieboldii,* are beautiful ornamental trees for attracting birds, as is the mountain-ash (*Sorbus aucuparia*). The fruits of the flowering Japanese quince (*Chaenomeles lagenaria*) and its varieties are eaten by some birds, and its spiny branches offer refuge.

In winter you should supplement the plant material you have provided the birds with feeding stations filled with seed mixtures and racks of suet and peanut butter. Water, too, is important the year round. In *Berried Treasure for Your Birds,* Mrs. Rockefeller suggests a winter bird bath by placing a plastic bowl in a box, 6″ x 6″ with a socket for a 25-watt light bulb beneath the bowl and attached to an insulated electric cord and weather-proof outlet. The heat from the light bulb will prevent the water in the bowl from freezing. D.E.H.

THE WILD FLOWERS OF THE NEW YORK AREA

By JOSEPH MONACHINO

Mr. Monachino is Associate Custodian of the Herbarium of The New York Botanical Garden.

NEW YORK WAS richly endowed as a natural area by its geographical position, physiography, and geological history. The original native flora must have been superbly varied. Old-timers still recall the orchids that grew at the upper end of Manhattan: *Tipularia, Liparis liliifolia, Goodyera pubescens, Corallorhiza odontorhiza, Spiranthes gracilis,* and *S. cernua.* The pink lady-slipper (*Cypripedium acaule*) flourished at High Bridge and near the approach to the George Washington Bridge in Manhattan. But New York was also highly favored for development into a gigantic metropolis. Steel and concrete assaulted earth and sky; skyscrapers, subways, and thruways blasted away the eternal rock with its mantle of moss and dug out the roots of herbs and trees and all growing things. Yet not all natural life is lost even within the maw of the Empire City, and if the Torrey Range is considered, some superb areas for naturalists still remain.

THE TORREY RANGE

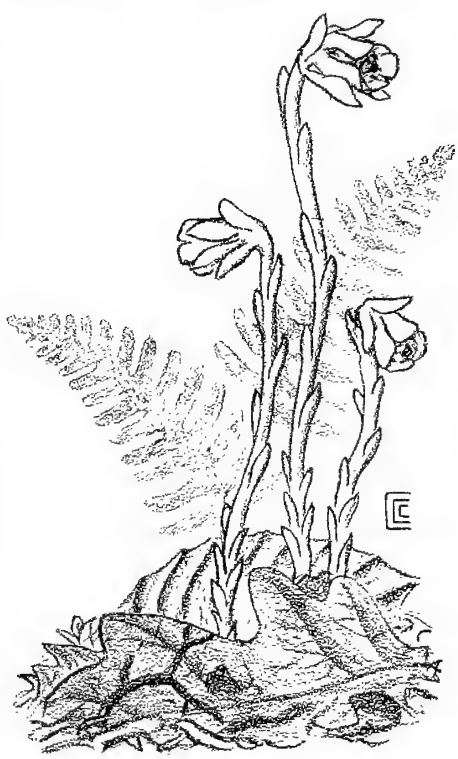
What is the Torrey Range? It is an area of approximately a one-hundred-mile radius around New York City, embracing southern New York from the Catskill Mountains down on both sides of the Hudson River, the entire length of Long Island, all New Jersey and Connecticut, and the fifteen counties of eastern Pennsylvania. A map of the region appears in Norman Taylor's *Flora of the Vicinity of New York.* The range was delimited in 1888 by the Torrey Botanical Club.*

PHYSIOGRAPHY

There is great diversity in topography, soils, and habitats within the sixty-one counties of the Torrey Range, and this has had a great influence on the flora. The mean temperature from the Catskill Mountains to Cape May varies from forty-five to fifty-three degrees, with a difference in growing season of over three months. The geological formations vary from the most recent to the oldest known (but phytogeographically young). Altitudes extend from sea level to 4,204 feet in the Catskill Mountains. There are the Taconics, the Hudson Highlands, the Shawangunks with Mohonk Lake and the Ellenville ice caves in which ice lingers until July; the Appalachian Kittatiny and Blue Mountains; the trap-rock Palisades and the Watchung; and the unglaciated Piedmont Plateau around Hunterdon County, New Jersey. The terminal moraine abuts directly on the coastal plain in Long Island. The Pine Barrens of New Jersey, exposed since Miocene times, are the oldest area in the Torrey Range continuously covered with vegetation. There are spectacular cliffs, ravines, shale ridges, talus and rock slopes, clay bluffs, limestone regions, serpentine barrens, sand dunes, ocean strands and bayside salt beaches, offshore bars like Island Beach in New Jersey, dry hills, old fields, wet meadows, fresh-water and tidal salt-water marshes, tussock swamps, cranberry and sphagnum bogs, rivers, fast- and slow-moving brooks, braided streamlets, lakes (the artificial lakes in the Harriman–Bear Mountain Park follow the natural contours of ancient glacial lakes), ponds, waterfalls veiled below with a cool spray-mist, baked mud flats which crack in irregular polygons, sun-beaten barren summits, woods where the leaf-filtered sunlight casts circular patches of light, and dark dank cedar swamps.

THE VASCULAR PLANTS

For the Torrey Range Norman Taylor listed 2,651 vascular plants (I have counted fifteen hundred within New York city limits), exclusive of casual introductions or waifs, distributed in 172 families and 830 genera. There are vouchers for these records; over sixty-seven thousand specimens are deposited in the Herbarium of The New York Botanical Garden. The largest families are the grasses, sedges, and composites. *Carex* with 155 species (Taylor's count) is more than twice as large as the next two largest genera combined. About half of all the known families of phanerogams or flowering plants are represented in the



* The Torrey Botanical Club, organized about 1866 and incorporated in 1873, is devoted to presenting and discussing original work in botanical research, to disseminating knowledge in plant science, and to inspiring a profound appreciation of our natural heritage. It is named in honor of John Torrey, who in 1819 published *A Catalogue of Plants Growing Spontaneously within Thirty Miles of New York.* From April to November the Torrey Botanical Club conducts field trips, now in their ninety-fourth season, for the study chiefly of botany and other natural subjects, and usually limits its operations within the Torrey Range. A printed field schedule lists the trips for the season. Membership in the Club is open to all, amateur and professional botanist alike, and members are welcome to bring guests to any meeting and field trip.

local range—one-third in The New York Botanical Garden. The larger families, like the legumes, roses, and orchids are quite amply represented. Since flower-structures within families are essentially alike, the local plants — the wild species—could serve, if carefully studied, as an introduction to a basic knowledge of the flora of the world.

Plant Forms in the Torrey Range

Examples of almost all plant forms or characteristics can be observed among the species found in the Torrey Range. The smallest known flowering plant, *Wolffia,* is seen in the lake in Van Cortlandt Park, New York City. The insectivorous pitcher plant (*Sarracenia*), three species of the sundew (*Drosera*), and several of the bladderwort (*Utricularia*) are in the New Jersey Pine Barrens. The parasitic dodder (*Cuscuta*) with its yellowish thread-like stem, the beech-drop (*Epifagus*) suffused with brown madder, and the waxy white ghost-flower (*Monotropa uniflora*) are to be found in The New York Botanical Garden. The ghost-flower or Indian-pipe turns black on injury or drying. Sometimes it is flushed with pink as if glowing with a rosy inner light.

There are ready examples of various morphological features: bulb (star-of-Bethlehem, *Ornithogalum umbellatum*), tuberous moniliform[1] rootstock (groundnut, *Apios americana*); stems that recline and root at the nodes (moneywort, *Lysimachia nummularia*), stems that turn to the left (wild yam, *Dioscorea*) or to the right (morning-glory, *Ipomoea*); stems that climb by cauline tendrils (bur-cucumber, *Sicyos angulatus*), by stipular tendrils (carrion-flower, *Smilax herbacea*), or by means of sensitive petioles (*Clematis*); stems that are square (cup-plant, *Silphium perfoliatum*) or triangular (umbrella-sedge, *Cyperus*). The stem of clearweed (*Pilea*) is translucent; the bark of the submerged stem of the swamp loosestrife (*Decodon*) is spongy-thickened; the pith of the claret-red stem of poke (*Phytolacca*) is wonderfully chambered; the stem of the sleepy catchfly (*Silene antirrhina*) has glutinous bands.

Arrowhead (*Sagittaria latifolia*).

There are opposite, whorled, alternate, entire, and feathery multi-sected leaves; septate[2] and terete[3] in some rushes; connate or united in boneset (*Eupatorium perfoliatum*), peltate or shield-shaped in may-apple (*Podophyllum peltatum*), pellucid-punctate[4] in St. John's-wort (*Hypericum*). The velvety-sheened, white-tesselated leaves of rattlesnake-plantain or *Goodyera* (Mianus Gorge) are probably the most beautiful in the local range. The prickly pear or *Opuntia* (Long Island and New Jersey) is leafless, and it is armed with barbed bristles. The hairs on the leaves of the nettle (*Urtica*) are stinging; on the leaves of the common mullein (*Verbascum*) soft-woolly and branched; and those on the leaves of the hoary tick-trefoil (*Desmodium canescens*) (Woodlawn, Bronx, New York City) so hooked that the leaves stick to one's clothes.

Nearly all the flower forms are represented in the Torrey Range. The hog-peanut (*Amphicarpaea*) has self-pollinating subterranean flowers. The showy fragrant flower of the water-lily (Staten Island and New Jersey) has numerous petals and stamens. The water-starwort (*Callitriche stagnalis*) is without a perianth; the minute male flower consists of only a single stamen and two inconspicuous bractlets. The corolla of *Viola* is papilionaceous, that of *Datura* trumpet-shaped, and either white or purplish. The corolla of *Lobelia cardinalis* (Passaic River, New Jersey) is blood-red, of *Myosotis* sky-blue, of *Cynanchum nigrum* (Pelham, New York) black-maroon, and of *Oenothera* pure yellow.

The fruits are long slender follicles in *Apocynum* and globular loculicidal[5] capsules in *Sisyrinchium.* Those of *Malva* separate into many indehiscent carpels. Medick (*Medicago*) bears spiraled legumes, tick-clover (*Desmodium*) clinging seed-joints or loments, and *Portulaca* capsules called pyxidia which burst open into an upper and lower half. The capsules of *Oxalis* and *Impatiens* are explosive. The achenes in the strawberry (*Fragaria*) lie on a fleshy edible receptacle, while those of the Indian strawberry or *Duchesnea* (Westchester County, New York) lie on a receptacle resembling that of the strawberry but spongy-dry and inedible. The berry-like fruit of *Gaultheria* is a capsule embedded in succulent red sepals that enlarge with age. The two red drupes of *Mitchella repens* are joined together or coalesced, whence the name of two-eyed berry. The heavy-fruited head of the arrow-arum (*Peltandra*) bends over into the mud on a swan-neck-like peduncle; the berries contain a tenacious mucilage. The berry-like fruit of doll's-eyes or *Actaea pachypoda* (Van Cortlandt Park) is china-white; the berry of nightshade (*Solanum nigrum*) is black, of *S. carolinense* yolk-yellow, of *S. dulcamara* red, of pokeweed (*Phytolacca*) dark purple, and of *Ampelopsis brevipedunculata* a most attractive turquoise.

What appear to be blue-black berries on blue cohosh or *Caulophyllum* (Van Cortlandt Park) are truly exposed

seeds. Seeds are as varied as pollen grains: globular or lens-shaped, linear, quadrate or nearly square, winged, appendaged, and variously ornamented. The endosperm is present or absent; the embryo is straight, curved or spiral. The seeds of the celandine or *Chelidonium* (Westchester County) are provided with an aril which is sought by ants. The embryo of *Impatiens* is robin's-egg-blue and tastes like walnut; that of certain pinweeds or *Lechea* (Pelham) is visible through the transparent seed coat.

The New York Botanical Garden

The multitude of plant characteristics noted above—and many more could be added—can be studied in species that are growing wild in the Garden or in nearby localities as indicated. The student need not go far afield to familiarize himself with plant taxonomy. He can locate over one hundred and fifty genera of wild plants in The New York Botanical Garden alone. Some of them are among our most beautiful natives: fawn-lily, spring-beauty, dwarf ginseng, Solomon's plume, jewel-weed, cow-parsnip, lizard's tail, spikenard, stargrass, cynthia, arrowhead, and swamp milkweed. There is a white form of the latter, too.

Many native plants, however, have disappeared. The ragged orchis (*Habenaria lacera*) once grew near Allerton Avenue in the Bronx, the pink lady-slipper in several places in the Hemlock Forest of The New York Botanical Garden. I recall last seeing *Liparis liliifolia* near the old Boulder Bridge about 1940. Trailing arbutus (*Epigaea repens*) grew on a ledge facing the Bronx River, near the South Bridge. One spring day, not very long ago, I went again to visit it—the place was covered with cinders. The wild pink (*Silene*) has expired. The orchids have gone, too, from the rest of the city. Ladies-tresses (*Spiranthes*) are an exception. They show a weed-like propensity. I have seen *S. cernua* on the lawns of homes along busy streets. This very year I chanced upon a small colony of helleborine (*Epipactis*) at the side of a path near the Snuff Mill in the Garden. How it got there is a mystery. But it is not a mystery how *Viola incognita* appeared along a stream in the northern part of the Garden; it was obtained by the violet specialist Ezra Brainerd many years ago for the artist Mary Eaton to draw, and then Miss Eaton planted it! Did *Aster acuminatus,* known nowhere else in New York City, find similar entry? I no longer see *Aster linariifolius* in the Garden. For the past several years I have not found the patch of *Viola rotundifolia* that grew at the side of a path in the Hemlock Forest. I know only a few individual plants of American alumroot or rock-geranium (*Heuchera americana*); these are near a rocky ledge where once an escaped fox made its den. Dutchman's-breeches (*Dicentra cucullaria*) and wood anemone (*Anemone quinquefolia*) are still here, but for how long? There is a white-rayed form of *Aster macrophyllus* on a declivity along the eastern bank of the Bronx River.

Trailing arbutus (*Epigaea repens*).

Introduced Species

The number of species in the Torrey Range has probably increased because of the introductions that have become naturalized. An example of this is the red-spiked *Polygonum cespitosum* var. *longisetum* that has become abundantly naturalized in the Garden and is the most striking wild flower here in November. The tall *Eupatorium* near the Waring Avenue gate is *E. serotinum,* well-fitted to stay in our flora. Near it is *Diplotaxis tenuifolia,* still displaying in November its many bright yellow, comparatively large cruciferous flowers which are well set off from the foliage.

The native plants that may have been completely eliminated from the general Torrey Range must be few up to the present time. It is different in small limited areas such as The New York Botanical Garden, Juniper Swamp (Queens County, Long Island), or Idlewild. I recall wading among yellow fringed orchis in Idlewild and seeing sundews, yellow-eyed grass (*Xyris*), and blazing stars (*Liatris*); but it is likely that for every native species lost, several hardy aliens have invaded meadows, roadsides, and waste places. Numerically there has been a gain—if this is any consolation.

(Continued on page 21)

1. moniliform. Resembling a string of beads; cylindrical, with contractions at regular intervals.

2. septate. Divided by partitions, seen by cutting the leaf longitudinally; or the nodulose septa (partitions) can be felt by squeezing the blade with the fingers.

3. terete. Rounded; having a circular transverse section.

4. pellucid-punctate. Dotted with translucent internal glands, seen when the leaf is examined against the light.

5. loculicidal. Dehiscent or opening naturally into the cavity of the locule or cell through a dorsal suture between the cell-walls.

CONSERVATION PRACTICES GIVE ZEST TO GARDENING

By ARTHUR B. BEAUMONT

Dr. Beaumont was with the Soil Conservation Service for eighteen years—six years in educational work, twelve years in administrative. Previously he spent eighteen years as agronomist with the University of Massachusetts. Since his retirement in February 1957, on reaching the mandatory retirement age, he has served as consultant. Dr. Beaumont, who has also had more than fifty years in practical gardening, is author of *Garden Soils, Their Use and Conservation,* and *Artificial Manures or The Conservation and Use of Organic Matter for Soil Improvement.*

MY RECTANGULAR LOT of one and a half acres lies on sloping land. The average slope is about ten per cent. At one place in the larger vegetable garden plot the slope is eleven per cent. Before conservation practices were initiated, there was some water erosion of unprotected soil. Now that the entire area is under a complete conservation plan, erosion is negligible and productivity is at a high level. Amazing results have been obtained.

I have seven garden plots and three small plots of rhubarb. Of the seven plots, five are used for flowers; the largest plot and one small one are for vegetables. The total area under cultivation is about ten thousand square feet.

On my entire suburban property twenty conservation practices have been established. Of these, fifteen are on or are directly related to the garden plots. I have demonstrated that many of the conservation practices recommended by the Soil Conservation Service for farm land can, with some modification, be applied to suburban home land. The practices established are: 1) Contour planting. 2) Across-the-slope planting. 3) Terracing. 4) Strip cropping. 5) Mulching. 6) Winter cover cropping. 7) Shallow cultivation. 8) Drainage. 9) Water conservation. 10) Irrigation. 11) Use of irregularly shaped areas. 12) Tree windbreak. 13) Permanent grass cover. 14) Summer cover cropping. 15) Composting. 16) Bank protection by vegetal cover. 17) Slope protection by water spreader. 18) Planting trees and shrubs for bird food, cover, and nesting sites. 19) Bird feeder. 20) Bird bath. Only practices on or directly related to gardens will be discussed in this article.

CONTOUR PLANTING is a basic practice in soil and water conservation. In its strict sense it means planting rows on the level; this is necessarily across the slope. Rows so placed tend to hold back the flow of water downhill and, therefore, reduce erosion and increase water absorption. In regions of abundant precipitation it is desirable to allow a slight variation from true level in order to promote drainage. This was the situation with respect to my contour flower bed, which has a grade of one-half of one per cent. This grade is sufficient to cause excess water to run off without washing the soil. Where it is desirable to save all the rainfall, level or exact contours are necessary.

ACROSS THE SLOPE. Where the terrain is so irregular that contour planting is not practicable, or for some reason is not desirable, the next best thing from the standpoint of conservation is to plant straight across the slope. This method is often sufficient for small garden plots, especially if it is supplemented with mulching. Across-the-slope planting is the method used on one of my flower plots, a small vegetable plot, and on part of my large vegetable garden.

A MINIATURE CROPLAND TERRACE runs approximately across the middle of my large vegetable plot. In effect, the terrace divides the plot into two nearly equal ones, thereby reducing the danger of erosion and simplifying the problem. The terrace has a base width of thirty inches and a channel depth of six inches. The channel has a grade of one-half of one per cent, which is sufficient to cause the discharge of water without erosion. It has carried water from heavy downpours. The water is discharged onto permanent grass sod, which prevents erosion. The terrace was built with a hoe, and some rebuilding is necessary each year.

STRIP CROPPING is the growing of tilled crops in strips which alternate with strips of permanent grass or other close-growing vegetation. The strips of grass slow down the rush of water across the tilled strips and strain out any soil that may have been carried from them, thereby reducing erosion and the loss of run-off. When practicable, it is preferable to place the strips on the contour, which is the case in my garden.

MULCHING is one of the simplest and most effective conservation practices for the garden and benefits it in many ways. Mulching will prevent erosion, reduce evaporation of soil moisture, check weed growth, improve the

Left. Contour-planted flower garden plot before mulching; hay for mulching is in cock at right background. Center. The same plot after it has been completely mulched. Right. The same plot three and a half weeks later.

physical condition of the soil, add organic matter to the soil, and, in the case of certain kinds of mulches, add appreciable quantities of plant nutrients. Splash erosion, caused by impact of raindrops on bare soil, the starting point of much erosion, is entirely prevented by a mulch. Splash erosion can be recognized by the presence of soil on flowers and vegetables after a hard rain.

I have used five kinds of mulches, some only for demonstrations. My principal mulch is hay, made from grass cut on land adjacent to the garden plots. This mulch is applied at the rate of eight to ten tons per acre. When freshly applied, it is ten to twelve inches deep, but it finally settles to make a mat one to two inches thick. Eight tons of hay contain about 272 pounds of nitrogen (N), 102 pounds of phosphoric acid (P_2O_5), and 288 pounds of potash (K_2O), in addition to quantities of some other major and minor

In this across-the-slope planting, mulched with hay, are pole beans, strawberries, onions, and tomatoes.

nutrient elements. All these nutrients eventually reach the soil through leaching and decomposition of the mulch, and they account in part for the high state of fertility my soil has attained.

My second most important mulch is hardwood leaves, which are as effective as hay in reducing evaporation of soil moisture and in keeping down weeds. They also carry considerable amounts of plant nutrients. They break down physically when walked upon, not enduring as much walking as does hay. To be effective in suppressing weeds, leaves, as well as other mulches, must be applied abundantly. Hardwood leaves are one of the most practicable mulches for the small garden, because they are generally abundantly available at little or no cost. I use leaves that fall on my own property, and some from my neighbors. They rake them up and give them to me instead of burning them.

I use considerable quantities of pine needles, collected from beneath my windbreak They contain less nutrients than are present in hay or hardwood leaves, and they gradually make a soil acid. But the latter is not a serious disadvantage because soil acidity can easily be corrected by the addition of ground limestone or wood ashes. I use pine needles mainly for mulching strawberry beds, for which they are especially good. I also use some lawn clippings for mulching. They are excellent for this purpose, as they are rich in nutrients and decompose rather quickly. They are in short supply. I have used sawdust and shavings which make good mulches but are practically destitute of plant nutrients. They break down slowly, and on that account are good for improving the physical condition of both heavy and light soils. They are important for increasing the humus content of soils. There are a number of mulching materials on the market such as peat moss, bagasse, and ground corn cobs. Most of these materials are too expensive to use except on a small scale or for a special purpose.

COVER CROPPING is another simple conservation practice for the garden. It gives many of the benefits that result from mulching, but it has limited application to gardens during the growing season. Winter cover cropping is most practicable for gardens. Sown in late summer or early fall, winter cover crops are effective in fall, winter, and early spring. They may be sown between rows of late-maturing crops before harvest. I have used oats and barley for winter cover crops. I prefer them because they winterkill in my latitude, and their residues are easily handled under my system of soil management. I do not plow, spade, or "roto-till".

Sweet corn is being chopped for compost; the compost bin is at right background.

Other crops than oats or barley may be used for winter cover; the choice depends somewhat on the length of the growing season. For northern latitudes, quick-growing small grains are usually best. Winter rye is popular, but it does not winterkill and has to be plowed or spaded under or roto-tilled. In regions of mild winters and long growing seasons, certain legumes, especially clovers, are good winter cover crops. Summer cover cropping is sometimes possible and desirable in gardens. This will be discussed later.

SHALLOW CULTIVATION. Only under exceptional circumstances, and usually incidentally—for example, in planting and digging potatoes—is my soil tilled deeper than two inches; usually not deeper than one inch. Also, because of the application of the mulch early in the season, the number of cultivations is necessarily reduced. Excessive aeration of the soil caused by frequent and deep tillage hastens the destruction of soil organic matter by oxidation. Hence, infrequent, shallow tillage is a conservation prac-

tice. A side advantage is the prevention of root pruning which results from deep tillage. The omission of the mulch early in the season, together with shallow tillage, promotes the warming of the soil by the sun's rays.

DRAINAGE of excess moisture from the soil is only indirectly a conservation practice. Drainage promotes better land use, which is helpful in a conservation program. By increasing productivity of wet land by drainage, erodible, well-drained land may be retired from cultivation.

WATER CONSERVATION and IRRIGATION. In addition to the conservation of soil moisture by mulches and through reduced wind velocity by the presence of a windbreak, rainwater from the roof of a large garage is caught and stored in three large tubs. This water is used in transplanting, for watering plants in dry situations during prolonged dry spells, for moistening compost, and for filling the bird bath. The principal portion of my garden, with deep soil and mulch, can stand a dry period of several weeks without suffering.

USE OF IRREGULARLY SHAPED AREAS. This is a facilitating practice. It makes possible the application of contour planting to an adjacent area. Between contour rows and straight rows across the slope is a triangular area. The most practicable way to plant this area is to a vine crop. I have grown melons in this plot a number of years with varied success. Lately I have used it for growing a small winter squash with great success. The plot is heavily mulched with hay.

TREE WINDBREAK. West and north of the large vegetable plot, across the path of prevailing winds, a pine tree windbreak was planted. It conserves soil moisture by reducing wind velocity, reduces wind damage to crops, and gives protection from cold winds in late autumn and early spring. It also yields an annual crop of pine needles for mulching the garden. To prevent it from cutting off my view of distant hills, the windbreak is pruned each year.

PERMANENT GRASS. Adjacent to all the garden plots is permanent grass. Some of it is kept as a lawn; the remainder is allowed to grow tall for hay. The tall grass, mostly orchard grass, is cut just before seeds mature, made into hay, and used for mulching garden plots. Compost, poultry litter, commercial fertilizer, ground limestone, and wood ashes have been applied to the grass sod as needed to maintain yields. For use as a mulch under my system, it is preferable to mow the grass before it matures seed, which means not later than June 10 in most years.

SUMMER COVER CROP of buckwheat is grown on an area which is being held in a stand-by condition for growing strawberries in rotation. Buckwheat grains are allowed to mature for bird food.

COMPOSTING of waste organic matter is an important adjunct to my gardening. Compost is prepared either in a wooden bin or in open piles. The bin is 5½ feet by 5½ feet by 4¼ feet deep, holds 103 bushels, and has an easily removable side to facilitate removal of the compost. Into the compost go sweet corn stover, surplus or spoiled vegetables, weeds, leaves, garbage, vacuum cleaner sweepings, and so forth. The aerobic-anaerobic, biochemical method of decomposition is used. A little nitrogenous fertilizer, ground limestone or wood ashes are added from time to time to hasten decomposition and fortify the compost. The compost is turned only when it is applied to garden or grass. It takes three or four years to fill up the bin.

Through the application of large amounts of organic matter as compost, mulch, and cover crop, limestone, wood ashes, and a small amount of commercial fertilizer, my soil has become highly fertile and productive. All gains in soil fertility have been held by conservation practices. The soil is in excellent tilth. Examples of yields obtained in recent years, expressed on the acre basis, are: potatoes (early), 800 bushels; onions, 924 bushels; tomatoes (ripe), 27 tons, (green), 7 tons; sweet corn, 26,700 ears.

Right. Contour-planted strawberry bed. Center. Buckwheat-cover crop. Left and rear. Windbreak of pine trees.

Spiritual satisfaction and material gains come from gardening the conservation way. It adds zest to gardening. Even on level land not subject to erosion, conservation gardening is worth while because, in general, practices which conserve soil also improve it.

YEAR-ROUND FLOWER PRODUCTION AT ERDENHEIM FARM

By WILLIAM H. WEBER

Mr. Weber has been at Erdenheim Farm since 1926; for the past twelve years he has been superintendent of grounds and greenhouses. At the Philadelphia Flower Show in the spring of 1960, Erdenheim Farm won the trophy for the "highest degree of horticultural perfection."

HERE AT Erdenheim Farm, in approximately ten thousand square feet of greenhouses, we grow many flowers and pot plants throughout the year. Erdenheim Farm is the home of Mr. and Mrs. George D. Widener. It is situated near the northwest edge of Philadelphia and consists of some forty different buildings, a one-mile training racetrack, a huge indoor tennis court, spacious grazing and farm lands, and acres of gardens and lawns.

As Erdenheim Farm is a private estate, pot plants and cut flowers are not grown according to commercial methods, but are specially cultivated to meet the year-around demands.

One house is devoted to some two thousand carnations, which are grown to provide flowers from October until

July. Since this is a ten-month demand every year, the young plants have to be grown in an unusual way, unlike that of the commercial carnation grower. Cuttings are taken in January and rooted in a bench of builder's gravel. Hormones are used to expedite rooting. When the cuttings have rooted, they are potted in two-and-a-half-inch standard pots and eventually shifted to four-inch pots. Pinching and feeding are done quite regularly, because the plants must stay in these pots until July. At that time the plants that have been flowering are discarded. New soil is brought in, and the young plants are put in the benches. These plants have eight to ten "breaks" and are ready to advance into flower.

We also grow roses successfully. We use plants budded on wild rose stock, known to rose growers as "volunteers"; their rate of growth is phenomenal. Our planting time is early spring. Roses benched in summer from grafted plants must root in the heat, and so do not establish themselves as well as those that are planted in spring and rooted in a much cooler temperature. We start our rose plants at 52° F. at night for at least two weeks and then raise the temperature to 60°-62° at night.

Chrysanthemums are another principal crop at Erdenheim Farm. We grow one hundred and twenty-five varieties of all types, and they provide flowers from September to January. Short days by the black-cloth method bring in the first mums, and the rest follow on their normal blooming dates.

Sweet peas are still grown in the old-fashioned way here, that is, each plant is kept to one stem, for this ensures large blooms and long stems. Two crops are raised. For the first, planted in September for winter flowering, the Spencer varieties are used; for the second crop, planted in November for spring flowering, the Cuthbertson or Zwolonek varieties are used, because they stand the hot weather better than the Spencers.

About a thousand lilies of all kinds are grown annually. *Lilium longiflorum* 'Floridae' or 'George Belle' is planted first for flowering at Christmas and is followed by 'Erabu', 'Croft', 'Estate', and others; and for June-July flowering the Japanese varieties are grown. Lilies can be grown cool (50° F.) or warm (60° F.), or the timing of flowering can be regulated by moving growing plants from a cool house to a warm house. Once the plants are submitted to heat, they cannot be cooled off to retard their flowering. Disruption of bud formation will occur, and that particular crop will be a loss.

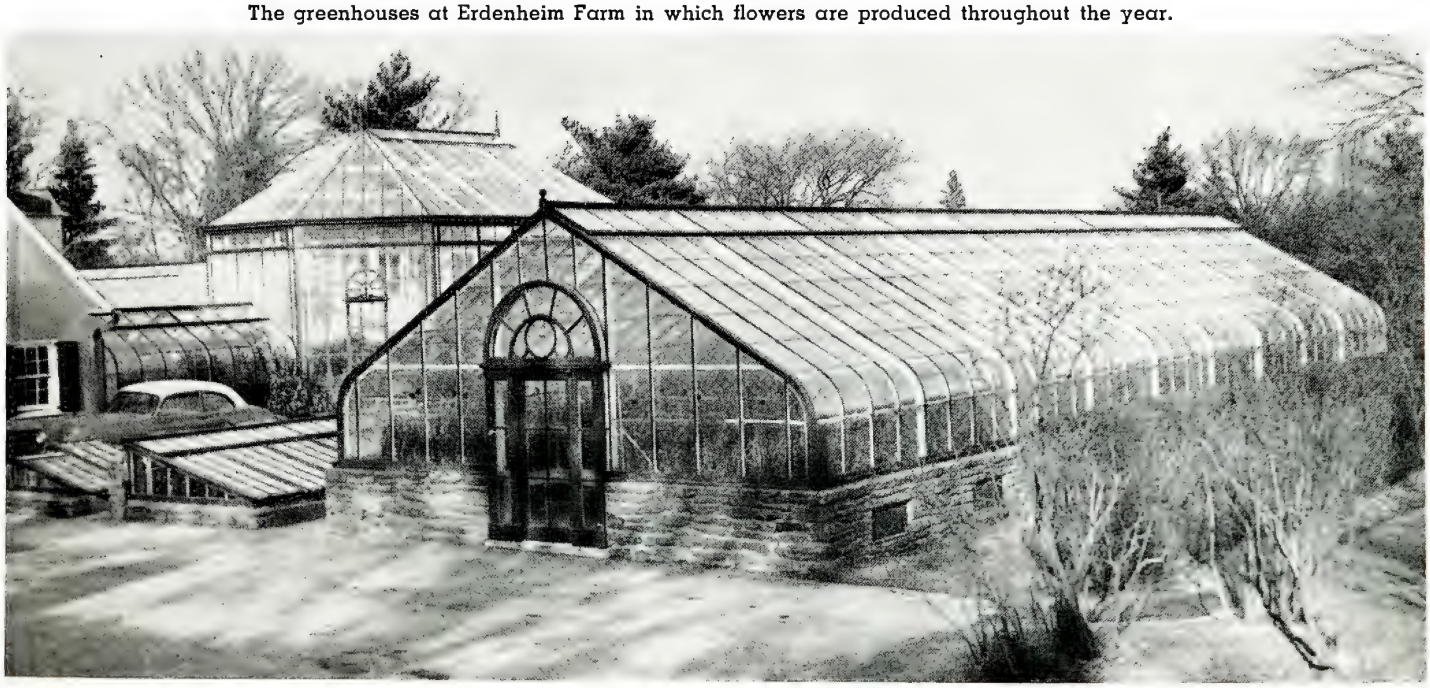
Several crops of snapdragons and stocks are grown each year for a succession of cut flowers, spanning a period from November to June.

In the orchid sections, cymbidiums, calanthes, oncidiums, cypripediums, and phalaenopsis are grown as pot plants and for cut-flower purposes. Calanthes provide cut flowers from November through March; *Oncidium splendidum* for midwinter, and phalaenopsis and cypripediums for sporadic flowering throughout the season. We have recently acquired some of the miniature warm-growing cymbidiums that make delightful small pot plants for flowering around Christmas time. One of these plants carried twenty-six spikes with three hundred and twenty-five flowers. We do not move cymbidium plants outdoors in summer as so many growers do. We believe our success in growing them results from keeping them under glass continually where we have better control of light and humidity.

All the orchids, with the exception of the oncidiums, are fed every two weeks during the growing period with soluble fertilizer and about three or four times during this period with a dry 6-8-4 fertilizer. Various mixtures are used for the potting medium. We still use osmunda for oncidiums and phalaenopsis. For the terrestrial orchids, we use a complex mixture which contains fir bark, peat moss, soil, and sand. Fir bark alone is not very satisfactory, but when combined with peat moss does a good job.

Calla lilies (*Zantedeschia aethiopica* and *Z. elliotiana*) are also major crops in the greenhouses at Erdenheim Farm. Grown in pots, they are fed very heavily throughout the season—from the time the plants are rooted until the growing season is over in May.

The greenhouses at Erdenheim Farm in which flowers are produced throughout the year.



The large-flowered Rutherfordiana and Indica types of azaleas are used exclusively for forcing as pot plants. They are started in fall and forced throughout the season, flowering from Christmas to May.

Nerines for October, cyclamen for midwinter, Rex and Clibran begonias for Christmas, calceolarias, nemesias, schizanthus, and *Clivia miniata* for spring—all are grown for pot-plant and cut-flower work. There is no doubt about it—we do keep the greenhouse benches well filled.

Of the bulbs that are potted in the fall for winter and spring flowering, freesias, tulips, hyacinths, and narcissi head the list. Contrary to most opinions, we find that freesias that are grown in a temperature of 60° F. to flower in January seem to be much better than those grown cooler. Tulips and narcissi are forced for Christmas flowering, as are iris 'Wedgewood' and the new 'White Wedgewood'. All of these bulbs are brought along at various stages through the winter for continuous flowering.

Mr. and Mrs. Widener like gladiolus very much, and as they are not in residence here during the summer when gladiolus flower normally, we grow three "out-of-season" crops. For the first crop, which is planted indoors in January for April-May flowering, prepared corms are used. The second crop is planted in a heated frame in March and brought into flower in June and early July. The corms for September-October flowering are held in storage until their planting time, July first.

Over three hundred hills of fifty varieties of dahlias are grown to provide cut flowers during September and October. Tubers or green plants (which have been started under glass) are set out June first and are disbudded until we let them begin to come into flower about September first. They will continue flowering until killed by frost.

Camellia japonica in several varieties is in demand for cut flowers every winter. Grown in ground beds in one of the large greenhouses, the plants produce a great number of blooms.

Several thousand annuals and perennials are started in the greenhouse every year to meet the requirements of the different gardens in spring and fall. Standard geraniums are always being brought alone for specific needs.

All seeds are sown in pure vermiculite in six-inch pans. Fine seeds are not covered; the larger seeds are covered lightly. After sowing, the pans are immersed to the bottom of the lip in water in which has been dissolved soluble fertilizer — one ounce per gallon—and oxyguinoline benzoate. This provides food to the germinating seeds and prevents damping-off. The pans are then placed in full sun under intermittent misting. The results from this method of starting seeds are very good.

A unique practice at Erdenhein Farm is to sow the seeds of hybrid Pacific delphiniums in August, grow them along slowly in the greenhouse all winter, and transplant them into larger pots as required. When March comes, they are shifted into eight-inch pots and forced in a temperature of 60° F. to flower in April and May. Visitors are always surprised at the sight of our delphinium plants as high as eight feet with flowering spikes more than three feet long.

Almost all the greenhouse crops are grown in a basic soil mixture. Since labor is scarce, and soil requirements are large, we are compelled to make our potting soil in big

William H. Weber examines one of the many standard geraniums grown at Erdenheim Farm.

quantities. We "roto-till" a section of bluegrass pasture to a depth of four inches and spread a good layer of cow manure, limestone, and fertilizer over the roto-tilled area. This is roto-tilled again several times during the year and then transported to a place near the greenhouses. To this basic material peat moss, sand, humus, more limestone, and fertilizer are added. We use this medium for growing almost every plant mentioned in this article. Recently a montmorillic clay, called "Turface," has been tried in place of the sand, but whether the results will be satisfactory has not yet been determined. "Turface," unlike sand, can absorb and adsorb moisture.

A strict sanitation program is carried out. We use poisonous phosphate gas (TEPP) for the general destruction of insects. Safety devices are employed to protect the operator applying the gas. When gassing or bombing is impossible because of weather conditions, we resort to spraying. Malathion we find is a good general-purpose insecticide; "Kelthane" is excellent for mite; "DiThane" is a very good fungicide; and "Slugit" an excellent control for slugs and snails.

By programming we find that it is possible to maintain control of all insects; we do not wait for insects to appear but take the necessary steps to prevent their appearance.

Fertilizing is also programmed. We use dry foods during warm weather. When cool weather sets in, we change to liquid foods because bacterial action is then at a minimum. Every time a section is fed, it is recorded; any "guess" work is thereby eliminated.

Temperatures are also controlled carefully during the winter months. This is most important. The temperature

(Continued on page 21)

FOREST PLANTS ON A CITY HOMESITE

By RAY R. HIRT

Dr. Hirt is Senior Professor Emeritus of Forest Botany of the State University College of Forestry at Syracuse University, New York. He is active in many organizations including the American Phytopathological Society, the National Shade Tree Conference, the American Holly Society, the Men's Garden Clubs.

TWENTY YEARS AGO we decided to purchase a city lot and build a home. After much searching we found a lot that provided a level front lawn, and at the rear a gentle slope leading to an upper level with flat to rolling ground. Adjacent to the rear of the lot was a relatively steep hill covered with native hardwood trees. The lot itself was an open hayfield eighty feet in front, one hundred and twenty-five feet at the back, and four hundred and twenty feet deep. The soil was clay loam underlaid with gravel. Even though the property was in the city, it had characteristics of a rural setting that appealed to us.

I have always been a gardener, particularly interested in vegetables, somewhat so in flowers, and with a desire to create a touch of forest environment about the yard. Thus, there was the challenge to combine my interests in such a way as to have open sunny areas, areas with color, and a few spots and paths in the dense shade of forest trees.

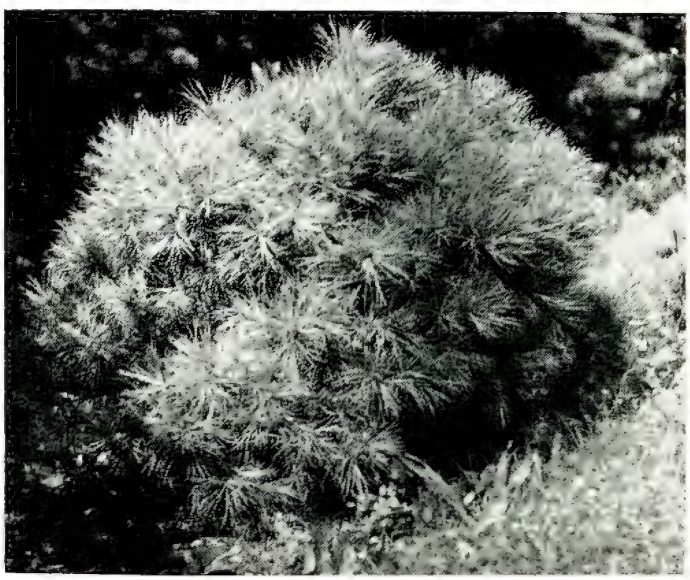
If our planting is unique in any way, I believe it is in the use of forest plants, particularly forest trees, and in the use of a few woody plants not considered to be winter hardy in central New York.

It is not my purpose to discuss the landscape designs of the property—I am a rank amateur at such work—but rather to mention some of the plants I have used, how I have used them, and the results I have obtained.

From the rear of the house to the rear of the lot, the area is screened in by several varieties of coniferous trees planted at the boundary lines. The trees are grouped and consist of white spruce (*Picea glauca*), larch (*Larix laricina*), Douglas-fir (*Pseudotsuga taxifolia*), red pine (*Pinus resinosa*), eastern white pine (*P. strobus*), and northern white cedar (*Thuja occidentalis*). Conifers were chosen because, with proper spacing to avoid deep shade, the branches down to ground level will retain their foliage, and a green screen will be provided throughout the year. Proper pruning once a year has kept the trees sightly and within bounds. Pruning has been done in mid-December, and the greens have been given to neighbors and our church for Christmas decorations. Fertilization of the trees was avoided in order not to stimulate growth. Rapid growth of certain conifers tends to leave considerable space between whorls of branches and makes the trees less attractive.

The "forest" effects were restricted to two small areas. Conifers were used because, on small areas, it is easier to simulate forest conditions with dense evergreens than with open-crown deciduous trees. At the rear of the lot adjacent to a few ash trees already present, four parallel forty-foot rows of trees, eastern white pine and Himalayan pine (*P. excelsa*), were planted. The trees grew rapidly, in part because of partial shade from the ash trees. As the tops closed in, the lower branches died and were removed. The area between two rows of trees was kept clear as a path. The remaining area beneath the trees was planted with various species of native wood ferns. Forest fungi became established in the soil and now appear as colorful mushrooms during the summer and autumn. Later, small eastern hemlocks (*Tsuga canadensis*) were planted adjacent to the last row of pines on the lot side, thus screening the view from the path of anything but trees, ferns, and native wild flowers. The environment is truly that of the coniferous forest.

A similar effect was created by planting a cluster of white



Bristlecone pine, a representative of the oldest trees in North America, is a "conversation piece."

Right. The true dwarf of eastern white pines retains its shape without pruning.

spruce and Japanese larch in a small swale near the west border. White spruce was used because they shape up nicely, bear cones abundantly at a very early age, and have an odor that we like. The trees were planted three feet by three feet and thinned at Christmas time as they became older. About fifty trees have been taken out. Some were given to the neighbors during the holidays, and in recent years large trees have been made available as church Christmas trees. Today, the remaining spruce trees provide a woods-like section for a path along the border.

Eastern hemlock is used in several places as a hedge between small enclosed areas, because this forest tree can be kept dense and held at almost any desired height by careful shearing once a year.

Originally Scots pine (*P. sylvestris*) marked the edge of a path bordering the vegetable garden. However, the trees became too tall, cast too much shade, and kept the lawn beneath cluttered with young cones from midsummer to late autumn. Then, too, on warm humid summer days young branch buds produced an obnoxious penetrating odor, much like decaying flesh. So, the trees were cut down and replaced with Swiss stone pine (*P. cembra*).

Swiss stone pine grows slowly, remains relatively narrow for many years, has interesting needle structure, and is a nice evergreen even for a small yard. Our trees have withstood several transplantings without ill effects.

A specimen tree that draws comment from visitors is a Jeffrey pine (*Pinus jeffreyi*), native of the Southwest. It has heavy, long dark green needles with a lemon odor. The trunk of the tree is dark-colored and relatively thick in proportion to its height. One young tree under heavy shade remained alive for many years but failed to grow and recently died. The tree in full sun has grown vigorously. When the oldest needles are dropped each year, they are permitted to remain beneath the tree where they slowly decay. This is the only effort of fertilization or soil adjustment to which we have resorted.

Other specimen conifers such as Macedonian pine, Korean white pine, Chinese hard pine, and Japanese red pine are growing on the grounds without special care.

A young "dawn redwood" (*Metasequoia glyptostroboides*), about sixteen feet tall, has grown approximately three feet per year for the last two years. It has withstood temperatures as low as —24° F. without injury. The lower

Swiss stone pine is used to mark a garden path, because it grows slowly and remains narrow for many years.

branches turn upward. The foliage is deciduous, of fine texture, and has an attractive autumn color. The bark naturally splits and peels in an interesting manner. The tree is very easily reproduced by late summer cuttings. It is particularly interesting because, until recently, it was thought to have been extinct some millions of years in the past.

Two bristlecone pines (*P. aristata*) approximately thirty-five years old, now about three feet tall, have been growing nicely in the yard. In the East these pines grow extremely slowly, commonly fail to develop a leader, and thus become a nice evergreen shrub useful for foundation plantings. The needles appear frosty because of resin spots that are normal to the foliage. The plants endure adverse growing conditions which are frequently fatal to other conifers. I suspect heavy fertilization might cause the trees to grow more rapidly and assume a tree form.

In the Adirondacks we discovered a true dwarf eastern white pine. It has no leader but is a ball of fine green foliage. The tree was transferred to our yard many years ago. Now the whole tree forms a green mound about two feet in

Left. This Colorado blue spruce has exceptional year-around color. Center. Jeffrey pine is a native of the California mountains. Right. The dwarf black spruce invariably draws comments from visitors.

diameter and has never been trimmed. Cions from the plant grafted on young stems of seedling white pines form new plants that continue the round compact shape of the parent plant. It is one of our "conversation" plants.

For contrast, deciduous shrubs and trees are used, but these trees are used sparingly. A white birch (*Betula papyrifera*) in front of Douglas-fir is interesting both in summer and winter. In the early spring with the morning sunshine on its mass of yellow male flowers in hanging aments, before leaves appear, the tree is a thing of unusual beauty. Its yellow autumn foliage is most attractive.

Redbud (*Cercis canadensis*) has been a most satisfactory tree. In the spring its mass of pink bloom assures us that cold weather is past. Its heart-shaped foliage is attractive during the summer, and its yellow autumn color is striking. Our tree originated as a seedling in Syracuse, and now its seedlings appear in odd locations in our garden and hedges. Our tree seems to be unusually winter hardy, having experienced our coldest winter weather without any injury other than a reduction in bloom.

Kentucky coffee-tree (*Gymnocladus dioicus*) offers an interesting contrast in size and form of foliage, and autumn color, as well as the rugged branching visible in the winter. However, the tree grows rapidly, becomes very large, and is not a tree for use on a small city lot.

A Korean oak (*Quercus dentata*) is often mistaken for American chestnut because of the shape of its leaves. The leaves are firm, a glossy deep green, and close together on the twigs; thus we frequently use the foliage for greens in flower arrangements, particularly for table settings. This oak holds many of its dead leaves throughout the winter, so that snow and ice accumulate on them and cause some of the branches to break, since the wood is relatively weak.

We have a native spice-bush (*Lindera benzoin*) at the edge of a much-used path because we like to pick an occasional leaf, crush it in our fingers, and enjoy the odor. Our plant is trained into a small tree; however, it can be retained as an interesting shrub.

A small specimen of bladder-nut (*Staphylea trifolia*) draws attention in the late summer and autumn because of its peculiar fruit, a small three-point pod within which the seeds rattle when the pod is nearly mature. Bladder-nut is a native shrub or small tree that grows well in light to heavy shade.

Native flowering dogwood, a severely pruned red maple, an Amur maple (*Acer ginnala*), and a staghorn sumac (*Rhus typhina*) are a few of the plants that add reds to the fall colors. From a golden-chain tree (*Laburnum anagyroides*) we anticipate a shower of yellow spring bloom. The tree seems winter-hardy in protected locations in central New York State.

About fifteen years ago we became interested in growing hollies and since then have tested the winter hardiness in our area of many species and varieties. The winterberry (*Ilex verticillata*) is native to our vicinity on moist soil and in flooded areas. We have found that it also grows well in our relatively dry clay soil, in shade and in sunshine, and fruits abundantly on the pistillate plants. English hollies (*I. aquifolium*) grow well, produce beautiful foliage, but rarely fruit because the flower buds are killed by low winter temperatures. They are in clay loam and naturally mulched by autumn drop of needles from nearby pines. Selections of American holly (*I. opaca*) have now reached a maximum height of ten feet. They fruit abundantly. Their old foliage is cast in the spring as new foliage develops. Most selections show some foliage discoloration in early winter, but there is always ample material for Christmas decorations and sprigs for packages. Each autumn we mulch lightly with pine needles and in the spring add a minor amount of fertilizer and iron chelate.

At this time we have fruits on our native American holly selections, winterberry, *I. pedunculosa, I. ciliospinosa, I. aquifolium donningtonensis,* and *I. platyphylla pallida.*

Several varieties of Japanese holly (*Ilex crenata*) grow well for us. We enjoy the beautiful foliage of *I. crenata convexa* and its sparkling black fruits, but our favorite variety is *helleri* because of its solid mound of dark green leaves. Varieties *microphylla* and *longifolia* frequently display minor winter injury. None of these hollies is given special care.

We have other woody plants, which we like greatly. It has been our plan to have home grounds that we enjoy—open lawn, flower beds, vegetable plot, play area, and woods environment. This we have accomplished without a cluttered effect, probably because we have tucked away many of the plants into inconspicuous nooks, mostly near the property boundaries. We have also made use of small compartments. The grounds are in no sense "park-like" but give a feeling of hominess about which our neighbors and friends remark. Most of this has been accomplished with woody plants of the forest.

FLOWER PRODUCTION (from page 18)

in a greenhouse is not allowed to vary more than two degrees from the specified temperature.

Among the minor crops—yet important in their particular uses—are lemon-verbena for finger bowls, crotons for gaily-colored leaves for fruit dishes, cherry or cocktail tomatoes, rosemary and tarragon for flavoring meat dishes.

Other lesser crops which are grown for specific purposes are double-flowering gerberas, poinsettia (*Euphorbia fulgens,* still often listed as *E. jacquinaeflora*) for Christmas, lily-of-the-valley, centaureas, *Ranunculus asiaticus* or Persian anemone, *Ixia* or corn-lily, *Sparaxis* or wand-flower, *Allium neapolitanum* or flowering onion. Thus, with major and minor crops, the greenhouses at Erdenheim Farm furnish their owners with a diversified and colorful display of plants through most of the year

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WILD FLOWERS (from page 13)

Much can be done with and for our native flora. The life history and biology of certain species can be profitably studied, as students from Rutgers University are doing in the William L. Hutcheson Memorial Forest (better known as Mettler's Woods). We hope eventually that Taylor's *Flora* will be brought up to date. Its nomenclature can be readily modernized by direct reference to the latest manuals; the many recently introduced species can be interpolated in the keys and text without too much difficulty; and an effort should be made to round-out the county records. The greatest effort should be put forth to save the local floras—this is foremost in importance.

A COUNTRY HOUSEWIFE'S GARDEN

By GERTRUDE B. FOSTER

Mrs. Foster is Editor of *The Herb Grower Magazine.*

WHEN JANUARY'S DAYS of strengthening cold and longer daylight focus attention on the plants before the frosted panes, in our window-sill gardens, there should be one ancient herb among the geraniums and gloxinias. It is the evergreen *Aloe vera,* the herb that has travelled with man on the long war-scarred road from Biblical lands to hospitals in this country where radiation burns are being treated.

The succulent pot plant, too tender to live outdoors except in tropical climates, asks very little of the indoor gardener. It takes a loose, sandy soil with a bit of lime, full sun, and very little watering during the winter. It stands the hot dry atmosphere of heated houses and apartments better than most house plants, and may be set out in the garden in summer. If taken from the pot before it is planted outdoors, the herb will increase by off-shoots or basal buds, which can be removed with a few roots attached to each small fan of leaves, to make many new plants when it is time to lift *A. vera* in the fall. From one plantlet of about five leaves sent to me in an airmail letter from California two years ago I have gained about twenty divisions.

There is no problem about what to do with such bounty. *Aloe vera* has a new role to play in modern life. It is of long repute as a bitter preservative and purgative in ancient times, but the recent research on it as a burn remedy verifies Scandinavian folklore. A plant of the very succulent aloe, which has white spots upon its light green, almost translucent leaves and awl-shaped, dull-pointed spines, used to be a common furnishing of Swedish and Norwegian kitchens. If the housewife burned herself on the wood stove, she reached over to the window sill, snapped off a leaf of the aloe, and painted the wound with the juice which almost ran out of the herb. The "gel," as it is called today, dried without stickiness and seemed to heal the burn without any scar. The healing property in the leaf juice of *Aloe vera* has started a new industry for Florida. Any little plants which are formed by my window-sill pots of this herb make welcome gifts for friends who like to grow their own first-aid herbs.

It takes a bit of digging among the early herbalists to find a frame of reference for the latest discoveries about the aloe. It was widely grown in the Middle East before it became a fairly common plant in our own Deep South. Maude Grieve, author of *A Modern Herbal,* describes the difference between *Aloe vera* and the plant called American aloe, really *Agave americana.* The latter is a plant of the New World and closely resembles the eastern and African aloes but has no medical application. The expressed juice of *Agave americana* is used in Jamaica as a soap substitute, since it lathers as well with salt water as with fresh. The leaves can be used for scouring pans, the decayed spongy substance of their interior serves as tinder where wood is scarce, and the fibers can be spun into thread. Mrs. Grieve mentions that the aloe flowers freely whereas the agave rarely blooms. I have seen pictures of large *Aloe vera* plants in bloom in California, and I await with interest any such exciting developments from the older plants in my greenhouse. Oddly enough, Mrs. Grieve makes no mention of the present-day use of the "gel" taken from the fleshy stems of *Aloe vera.* Species of *Agave* are often seen in window gardens, as the variegated types are valued for their golden markings.

The purgative qualities of *Aloe vera* and other species gave the most dramatic evidence of its medical properties through the ages. Fortunately, few such doses are administered today, but aloe will gain from its older qualities as a vulnerary. The first-century Greek herbalist Dioscorides praised it in these words: "By being sprinkled on drie it conglutinates wounds, & brings to a cicatrix boils, & represseth them. . . .".

In 1597, John Gerard called aloe "Sea Houseleeke". He claimed that if a bit of earth covers the root and it is now and then watered, it can be hung on ceilings and upper posts of dining rooms and, though out of the earth, will remain green. He elaborated on Dioscorides' praise of it and affirmed that it will stay bleeding of fresh wounds, keep hair from falling "if the head be washed therewith: and mixed with wine and honie: it is a remedy for... swelling of the gums and all ulcers of the mouth."

Before he discussed "the vertues," Gerard had a word to say about another application: "The herbe is called of the later Herbarists oftentimes Sempervivum, and Sempervivum marianum, bicause it lasteth long after the manner of Houseleeke. It seemeth also that Columella in his 10 booke nameth it Sedum, where he setteth down remedies against the cankerwormes in trees: In English thus

> Liquours of Horehound profit much being powr'd on trees;
> The same effect Sea Houseleeke works as well as thees."

A severe sunburn and inquiring mind led Rodney Stockton, a chemical engineer, to investigate the age-old folklore about the healing properties of *Aloe vera.* When he experienced a bad case of sunburn in Florida in 1945, he heard of the Seminole Indian practice of using the juice of the raw plant to heal incisions made under surgery. Leaving his business in Chicago, he returned to Florida to initiate research on the plant that was a common yard herb there. Now a substantial planting of *Aloe vera* is providing work for farmers, and the Aloe-Creme Laboratories has Government contracts for its products as a result of its success in stabilizing the "gel." Ointment made from it has proved sufficiently active to change a deep thermal burn into a minor first- or second-degree burn within forty-eight hours and to increase healing by fifty per cent, with little scar tissue.

The "gel" is filleted from the leaves of mature plants of *Aloe vera* with great care to avoid contamination with the chemicals in the epidermal layer. The dried juice of the basal portions of the leaves that contained "aloin" was used as a laxative for centuries; this is drained off in making burn remedies and skin creams. Aloe-Creme ointment was used in a study of untreated and treated thermal burns which was reported in the August, 1959, issue of *Industrial Medicine and Surgery.*

Round-the-World Impressions of Floral Art

By ESTHER WHEELER

Mrs. Wheeler has won many awards for her arrangements, has written and lectured about flower arranging, and is co-author with Mrs. Sam Lasker of *The Complete Book of Flowers and Plants for Interior Decoration.*

WHILE I ANTICIPATED exciting experiences on my recent trip around the world, they went far beyond expectations.

Hawaii is truly a flower-lover's Paradise—the plants are magnificent. Ti leaves (*Draceana terminalis*), white anthuriums, banana blossoms, hibiscus, and crotons were abundant everywhere; octopus tree (*Brassia actinophylla*), red anthuriums, and orchids were used lavishly in stupendous compositions; hundreds of fragrant leis were for sale "to be shipped to the mainland." I was sorry when it was time to leave this glamorous Island. Yet when the plane approached Japan, and I saw the tiny patches of lush green growth through the fog, there was something about them that appealed greatly to me. As I stepped from the plane, I saw that these geometric strips were cultivated right up to the runways.

It was at the entrance to the dining room of the new Imperial Hotel that I had my first sight of a flower arrangement in Japan. This represented a landscape and covered a large round table. Rocks, a little bridge over a stream, a stone lantern, many little dwarf evergreens, and a grouping of white iris buds, all in perfect scale, composed the picture. During my short stay at the hotel, I watched the buds unfold, and gradually the little scene was filled with fully blown iris. The lobby held many arrangements in the modern style, reminiscent of the West, yet with one difference; the principles of receding and advancing rhythm were practiced to show depth.

Flower arrangement plays an important part in the decor of Japanese rooms. While there are different schools, the basic principles are the same. Every arrangement is made to symbolize "heaven, man, and earth": the main shoot represents heaven; the branch or shoot bent sideways to the right or left denotes man; and the lowest, bent so that it points forward, signifies earth.

The term "flower arrangement" is used in a broad sense, since not only flowers but flowerless trees and shrubs are also widely used in Japanese flower arrangements.

May is the month of flowers in Japan, and so our party of twenty-four visited Nikki where azaleas and wisterias in full bloom on the mountain slopes looked like a beautiful floral tapestry.

In Tokyo our group was enthusiastically received at the Ohara Center. There we observed a flower-arrangement class in action; the lesson was on an arrangement in the Nageira style. The students, about one hundred and fifty, stood in front of tables on which their tall containers were placed. They carefully studied each branch of spiraea, fastened them in the vase, and added three peonies. This was the final examination after studying this one style for a month, and they were to be graded on their work. No wonder they were good!

Our next visit to the Sho-fu School, where the "Master" is Mrs. Josui Oshikawa, who lectured and taught in the United States. Mrs. Oshikawa was to have lectured on Rose Day, June 10, 1959, at The New York Botanical Garden, but was prevented from doing so by an accident. Two of her assistants, Mrs. Ginsui Kobayashi and Mrs. Sensui Ide, substituted for her and demonstrated the use of roses in Japanese flower arrangements. They returned to Japan and are now teaching in the Sho-fu School.

(Continued on page 33)

THE TORREY BOTANICAL CLUB HONORS BERNARD OGILVIE DODGE

MORE THAN one hundred and twenty-five members and friends of the Torrey Botanical Club gathered in Philosophy Hall, Columbia University, on October 25, 1960, to honor the late Bernard Ogilvie Dodge, Plant Pathologist Emeritus of The New York Botanical Garden.

Dr. William J. Robbins, Director Emeritus, who was chairman of the program, spoke of Dr. Dodge's ancestors who had settled in New England in the seventeenth and eighteenth centuries; of his father and mother, who had married early and migrated to Wisconsin, and their influence upon him; of his boyhood on his father's farm, and his years as a student and high-school teacher, his identification with Columbia University, his intense enthusiasm and success as a teacher, and his persistence in research. Dr. Robbins said in part:

"Dr. Dodge's concern with fungi as causes of disease extended from plants to animals, including man. From 1928 to 1939, he served as Consultant in Mycology for the Presbyterian Hospital, New York City, and from 1929 to 1960 he was Lecturer in Dermatology for the College of Physicians and Surgeons of New York City.

"For about twenty years he was responsible for the practical control of plant diseases and insect pests at The New York Botanical Garden—the Rose Garden was his special care and delight—and along with this burden pursued research in plant pathology, cytology, and genetics, wrote in cooperation with Dr. H. W. Rickett a text on the diseases of ornamental plants, and played a responsible role in local, national, and international botanical organizations. But Dr. Dodge, like his father before him, was essentially a teacher and nothing pleased him more than to enthuse some beginner or colleague for the subject in which he took so great an interest, and few could resist him. It is impossible to list all those who felt his influence. They include Carl Lindegren, I. R. Hirshkowitz, Myron Backus, S. F. Pady, Jesse Singleton, Esther Zimmer Lederberg, Marjorie Swift, Alice Aronescue, F. Li Tai, Thomas Laskaris, George Bistis, and many others. . . .

"Dr. Dodge's contributions to science were widely recognized in this country and abroad. He was a member of Sigma Xi; a member of the National Academy of Sciences, Fellow of the American Academy of Arts and Sciences, Fellow of the American Association for the Advancement of Science, Foreign Member of the Linnean Society of London, and Honorary Member of the British Mycological Society. He was honored by being chosen a vice-president of the seventh International Botanical Congress at Stockholm, President of the Mycological Society of America, and of the Torrey Botanical Club. When he received the Golden Jubilee Award of Merit of the Botanical Society of America, the citation read:

> "Bernard Ogilvie Dodge, whose perceptive researches into the taxonomy, evolution and pathological relations of the fungi have not been surpassed, but only overshadowed, by his discovery and exploitation of *Neurospora* as a principle of genetical truth."

Dr. P. P. Pirone, who succeeded Dr. Dodge as Plant Pathologist at the Garden, said in part in discussing Dr. Dodge's contribution to plant pathology: "During the nine years with this organization [U.S. Department of Agriculture] he was author and co-author of a number of publications. In my opinion his best plant pathology publications during this period were those dealing with systemic infections of the genus *Rubus* with the orange rusts, published in the *Journal of Agriculture Research.* Even today these are models of outstanding research and lucid writing. . . Another excellent contribution was the publication, in 1926, with R. B. Wilcox, of U.S.D.A. Farmer's Bulletin 1488 entitled *Diseases of Raspberries and Blackberries. . . .*"

Dr. Dodge's work during nearly twenty years at the Garden included research and observation on diseases of iris, Japanese cherries, roses, geraniums, cedars, marigolds, opuntias, and many other ornamental plants.

Dr. Pirone continued, "I believe that one of Dr. Dodge's greatest and most lasting contributions to plant pathology was the publication, in his seventy-first year, with Dr. Harold William Rickett of a 638-page book on *Diseases and Pests of Ornamental Plants.* . . This book was well received by scientific workers and professional amateur gardeners throughout the English-speaking world. It was also the standard text on ornamental disease and insect problems in universities offering courses in plant pathology.

"I helped in a slight revision of the book in 1948 and, at Dr. Robbins' suggestion, made an extensive revision with Dr. Rickett's help in 1959. It is my fond hope that over the years this book will serve as a constant memorial to an outstanding scientist and a fine gentleman, Bernard Ogilvie Dodge."

The importance of Dr. Dodge's work for the genetics of fungi was presented by Dr. Lindsay S. Olive of the Department of Botany as a joint contribution by Dr. Francis J. Ryan of the Department of Zoology and himself, both of Columbia University: "'What a remarkable man!' This was the statement so often heard from a new student who had met Dr. Dodge for the first time. As he walked through our Columbia laboratories and saw either of his old favorites, *Ascobolus magnificus* or a new isolate of *Neurospora,* he would shout with pleasure, and everyone on the floor would know he was there. Or, upon seeing an old student or associate strolling through the grounds of the Botanical Garden, he might toss his hat into the air in enthusiastic greeting. Transfixed by a picture of *Pilobolus* in his old stereopticon viewer, he would exclaim to students little more than, 'Oh, boy! Oh, boy!'

"We shall remain transfixed by Dodge's image. He was a kaleidoscope on the scientific scene, a sound and important scientist, motivated by unfailing curiosity, good will, and perennial optimism, a man who has helped bring science in America to a position that does not embarrass us before our colleagues in other parts of the world. Dodge and his favorite organism, *Neurospora,* have had a specific and lasting influence on the course of biological research.

"He had passed the age of forty when his first paper in mycology was published, his last appeared when he was eighty-five. He was fifty-five when his major life's work—the genetics of *Neurospora*—began. What a supreme ex-

(Continued on page 32)

"FLOWER DAYS" AT HEIDELBERG

By HERMAN F. BECKER

Dr. Becker is Visiting Research Associate at The New York Botanical

A VISITOR TO Europe, whether he is professionally interested in plants or is a casual tourist, cannot help being impressed with the accent on flowers and floral displays. Flower shops, in contrast to many of them in the United States, actually sell flowers and flowering plants, not just snake plants, philodendrons, and colored creations of papier maché. Our customary gift-boxes of candy are replaced by the most diversified array of cut flowers and potted plants. The smallest towns and largest cities mirror a natural pride and innate love for flowers, a truly cultural aspect of the less sophisticated world of our ancestors. In France and in Switzerland, in Germany and in the Scandinavian countries, we find not only small and well-kept parks with flower beds, formal or otherwise, but a profusion of blossoms gracing the dividers of streets, surrounding prosaic gasoline pumps, and overflowing the window boxes of houses, public buildings, fountains, statues, and even bridges. In market places on the square and around churches and cathedrals, flowers are the outstanding merchandise of the vendors, whose stalls or carts are laden with a colorful variety. Rich and poor alike buy flowers with their daily purchases. One has the feeling that flowers belong in every home, that they are a necessity to daily life.

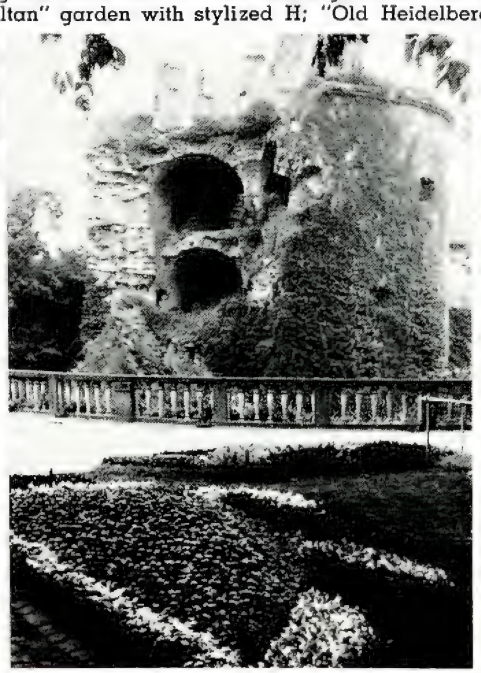
No ordinary photograph can convey their gaiety and esthetic contribution which are perceived by anyone who is susceptible to beauty in nature. Pictures or descriptions cannot do justice to the visual impressions, and even color slides and film are not entirely satisfactory substitutes for the more permanent emotional values evoked by vivid memory. An illustrated book would not suffice to delineate the multitude of imaginative floral presentations; for this reason only one spectacular display is presented here. The "Blumentage" (Flower Days) in Heidelberg, West Germany, may serve as an example of what is to be seen, in varying degrees, in many other towns of Europe.

Formal low border near the flag-lined entrance to the castle gardens.

In the formal beds near the entrance to the castle gardens, a Roman X and "Blumentage" are depicted in red wax begonias on white gravel.

Heidelberg is famous for its university; it is also famous for the ancient castle that dominates the upper part of the city on the left bank of the river Neckar. The castle is nestled in the steep side of a hill (Schlossberg) and is accessible by road, trail, and funicular railway. Within the castle and on its grounds, annual flower displays or "Blumentage" are held in August under the auspices of the city

Left. Renaissance and Baroque gardens along the south wall of the castle grounds. Center. Ancient tower at the southeast corner of the castle overgrown with ivy. Right. "Altan" garden with stylized H; "Old Heidelberg" is in the distant background.



of Heidelberg with the cooperation of flower shops and nurseries in the vicinity. The well-kept castle grounds are eminently suitable for such displays.

The "Flower Days of 1960" were the tenth recurrence of this exhibit and for this reason, perhaps, were particularly lavish and colorful. The week-long anniversary began with the grand opening in the festively decorated royal ballroom of the castle, where exquisite cut flowers and tropical plants were on display. Musical events included a Viennese evening, a Mozart evening, concerts, folksongs and serenades, and the Tonawanda Children's Choir which provided entertainment as guests from the United States. Illuminated flower displays, dancing, fireworks, and a grand illumination of the castle attracted local and foreign visitors alike.

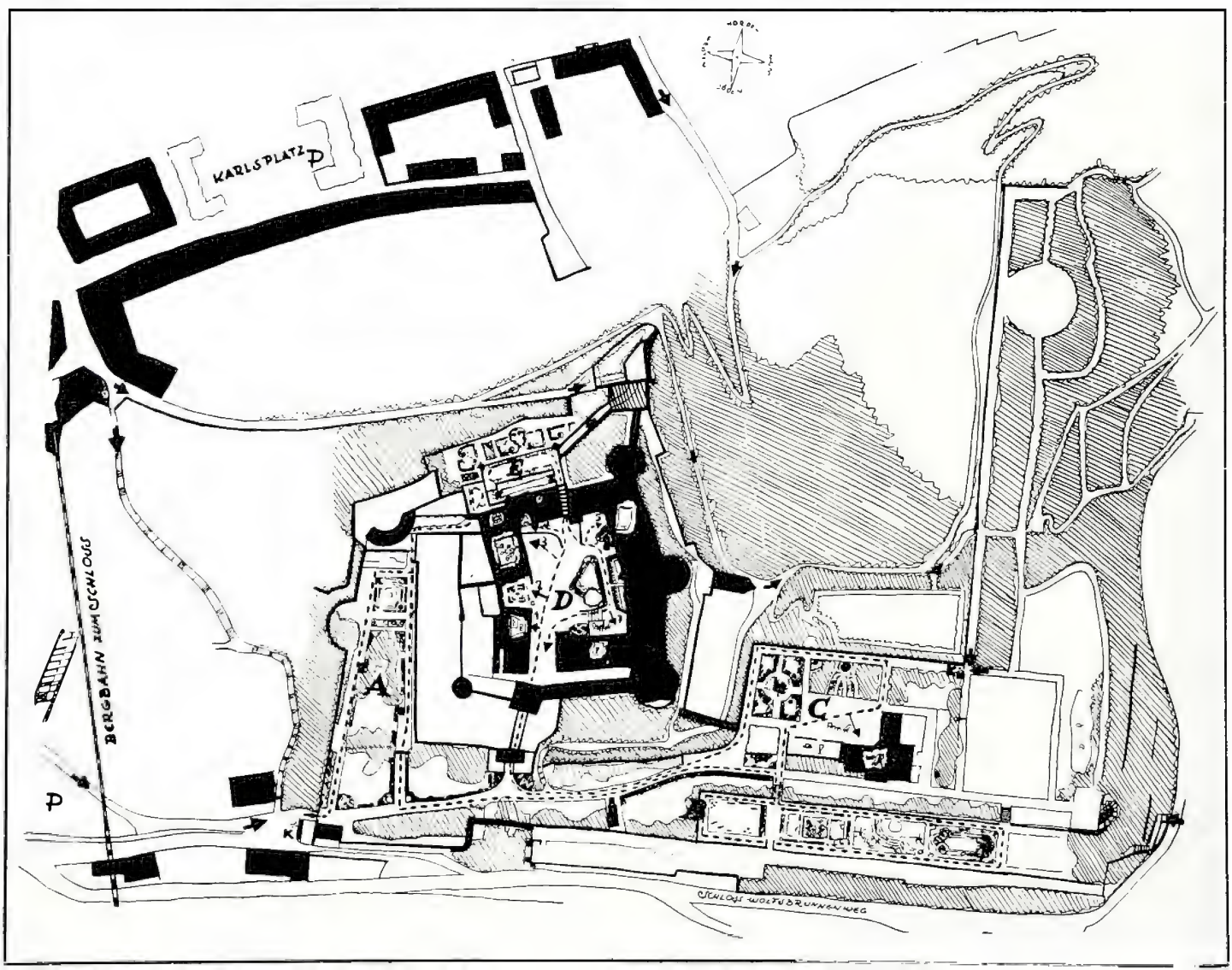
Beginning at the entrance, the wide and well-kept paths were lined with flags from all nations. These greeted the visitors from other lands and made them feel warmly welcome. Gardens within a garden represented features from medieval times, the Renaissance, and the seventeenth century, and there was a partial replica of the ancient "Hortus Palatinus," according to its original creator Salomon de Caux. Another garden duplicated a motif of the early Baroque with strong and rigid forms. Whenever possible the gardens did justice to existing shrubs and trees and, as in the case of some stately redwoods, immeasurably enhanced their effect. A large terrace was transformed into a "bird paradise;" huge cages, camouflaged with reeds, bamboo, and palm fronds, harbored mostly native birds in a somewhat Tahitian or South-Sea atmosphere.

Within the compounds of the castle proper, small formal beds, window boxes, tubs, and jars were effectively arranged to break the monotony of pavement, or to enliven weird old towers, walls, and ruins. The exhibitors succeeded in keeping a modest tone of form and color, never loud or overbearing.

A very impressive view of Heidelberg, the river, and the mountains is obtained from the "Altan," a wide, open gallery or balcony which seems to be suspended above the sprawling city. Below this a long and narrow terrace was devoted to beds of extremely formal construction, depicting landscape design of the climax of the Baroque. As the central motif, the beds culminated in a huge "H" in green and white, symbolizing Heidelberg, and reminiscent of designs at Versailles.

A list of all the plants and flowers that went into the making of the "Blumentage" is not available. Most of them are dwarf, low-growing, profusely flowering annuals and perennials. Some of them are adapted to sunny, some to shady locations; some lend themselves to shearing; and some of them were used en masse. Following are the plants that were most frequently used: ageratum, alyssum, asters, begonias, both tuberous and wax, calendulas, funkias, geraniums, heliotrope, impatiens, iresine, kochia, lobelias, marigolds, petunias, phlox, salvias, snapdragons, stocks, sweet Williams, verbenas, zinnias; also alternanthera, coleus, ivy, pachysandra, and vinca.

Key to the "Blumentage" in the Castle Gardens of Heidelberg.
A. Historical Rose Garden and coat-of-arms.
B. Renaissance and Baroque Historical Gardens.
C. Terrace with "bird paradise."
D. Central Court of Castle with Medieval Gardens.
E. "Altan" with Baroque motif.



BOOK REVIEWS

PALMS OF THE WORLD. McCurrach, James C. 290 pages, illustrated. Harper & Brothers, New York. 1960. $17.50.

For years palm enthusiasts have lacked a book on palms of any comprehensiveness, which would serve for identification and reference. One can find very little material on palms in most libraries. Even persons having access to large botanical libraries have difficulty in finding photographs of certain species, for example, *Teysmannia altifrons;* and the collections of palm photographs, contained in this large, well-illustrated book, are therefore particularly welcome.

There are reasons, of course, why popular palm-identification handbooks have not been published before. First, the general public has not had access to tropical regions and contact with palms, but air-transportation and the growth of Florida and California have made palms as familiar as oaks or maples. Second, it is difficult to compress so much botany into a single volume—and palm botany is particularly difficult, for there is confusion in names and identities. For example, *Rhapis* species are practically unidentifiable, *Thrinax* nomenclature is confused, and in *Phoenix* hybridization is a difficulty. Third, palm material is in many foreign languages. Fourth, assembly of illustrations from all corners of the globe is an expensive project.

The author has drawn on photographs already published in *Gentes Herbarum* for about one-fifth of his illustrations; about one-tenth came from *Palms and Cycads* by William Hertrich; about one-eighth from T. Satake in Japan and ten are from Ethelbert Blatter's book, *Palms of British India and Ceylon.* There are about four hundred photographs in *Palms of the World* as compared with only eighty-five photographs in Alex Hawkes' excellent book, *The Major Kinds of Palms.*

The greatest amount of space is devoted to those genera which are most common or suitable for Florida or California. These are *Sabal, Phoenix, Copernicia, Roystonea, Livistona, Coccothrinax, Pseudophoenix, Veitchia, Erythea,* and *Syagrus.*

About two hundred and thirty-five genera are treated—sixty per cent of them in detail. Of the remaining forty per cent only the country of origin is given. The detailed description of each species systematically follows a uniform pattern under the headings of common-name, origin, sex, trunk, petiole, leaf, leaflets, or segments, flower-stalk, fruit, seed, and oddities. The word spadix is seldom used; flower-stalk is substituted. The descriptions are concise, accurate, and convenient. An illustrated glossary of palm-terms precedes the main text. A section on "Cultivation and Seed-Germination" has been provided for many species; this information was compiled by Florida and California palm growers.

There are some criticisms. The alphabetical arrangement of genera obviates an index, somewhat, but one would have been preferable. The photo of *Deckenia nobilis* is in error, I believe; a sabal-type is shown. *D. nobilis* has a crown-shaft. The sago-palm should have been illustrated. *Pholidostachys* is labelled Malayan instead of Costa Rican.

Certain palms assume a somewhat different appearance when they grow in Florida from that in their native land. For example, *Hyphaene* in Florida never has the multi-branched appearance shown on page 104; the Florida habit would be more useful for identification. *Ceroxylon andicola* never will grow in Florida, whereas copernicas grow wonderfully there, as shown in the illustration of *C. baileyana,* yet are seldom planted in Florida.

Photographs of unusual interest are: the tall *Livistona rotundifolia* with ringed trunks; the even taller *Ceroxylon;* the great *Raphia ruffia* with fifty-foot leaves dwarfing the man below; *Eugeissona tristis* with its numerous thorns; the *Socratea* with ten-foot stilt-roots; the *Leopoldinia* covered with hair from top to bottom; the *Metroxylon amicarum* and its ivory nuts; *Pelagodoxa henryana* and *Teysmannia altifrons* with paddle-leaves which are entire and not segmented.

Many years ago, several books of a popular nature were published in Europe — Seemann, B. C.: *Die Palmen* (1863); de Kerchove, Oswald: *Les Palmiers* (1878); Salomon, Carl: *Die Palmen* (1887), Gatin, C. L.: *Les Palmiers* (1912). These are now out-of-date. Martius' great palm books were subsidized by the German government. The U. S. government could follow such an example.

The present volume is destined to become a standard reference for palm enthusiasts and, I hope, will be expanded in future editions.

R. B. KURTZ
New York, N. Y.

SOIL, GRASS AND CANCER by Andre Voisin. Foreward by H. M. Sinclair and Dr. Allen Fraser. Translated from the French by Catherine T. M. Herriot and Henry Kennedy. Front., 17 ills. (including plates, photos, drawings, charts), 39 tables. Bibliography (18 p.). Index of authors plus subject index. Cl. xvii plus 302 p. Philosophical Library, New York. 1959. $4.20.

As Dr. Fraser so aptly states in his forward "... without a doubt, the health of both animals and men is linked to the mineral balance of the soil."

This book is the preface to a larger work which M. Voisin is preparing for publication, dealing with the influence of the soil on the metabolism of the living cell.

An organism is the biological photograph of the environment in which it lives. But this can only be true if it receives no outside nourishment. In primitive societies man eats the products of his immediate environment. He gathers fruit, grain, vegetables, greens and animal products from a small territory. Today we eat the products grown on a variety of soils in many parts of the world.

To provide a true picture of the effects of local soil conditions, M. Voisin chose grazing animals and Indians living on reservations as subjects for his study.

Although many physicians, nutritionists, animal husbandry men, soil scientists and botanists may not agree with all his statements, he cannot be ignored. This work brings together the interrelationships between the chemical aspects of soils and animal and human nutrition, and their well being. It should stimulate the further study of this vital problem. JOHN ASCH

THE FOREST AND THE SEA. Marston Bates. Random House, New York. 277 pages, indexed. 1960. $3.95.

Every scientist is called upon to review many more books than he can handle properly. The all-too-frequent solution to this problem is to "skim" the book, see if your own work is cited (thus guaranteeing a favorable review), plagiarize the dust jacket, and write a short paragraph. On occasion, a book of vital importance to your own field demands and receives a thorough examination and evaluation. Rarer still is the volume from a biologist which is so enthralling that it is read completely for pure intellectual pleasure. *The Forest and the Sea* is just such a book.

Dr. Bates is now Professor of Zoology at the University of Michigan after a long and distinguished career in public health work. This book, the eighth that he has written or co-authored, is essentially the reflections of a mature biologist with unusually broad experience and considerable facility in writing. It attempts successfully to discuss the interactions of organisms with their biotic and non-biotic environment. Its pertinence to man's activities is forcefully and cleverly pointed out. The "captured" reader, and there will be many of them, is presented with auxiliary reading in an informal Notes and Sources section.

It would be unfair to Dr. Bates to attempt to summarize all of his ideas. These are developed gradually from diverse observations and reflections on a wide variety of organisms and conditions. He has, for example, looked at the environment from the mosquito's point of view —and almost incidentally presented some unsettling thoughts for behavioristic psychologists to ponder. He has presented some provocative ideas on the domestication of plants and animals (including man!). His reasoning for the conservation of natural areas is sound and important. As an individual, I disagree with much of the material in his chapter on the place of man in nature, but his discussion and examples are cogently arranged and his conclusions are logical. Nevetheless, the fact that he made me *want* to discuss it further is the most salutary feature of the book.

RICHARD M. KLEIN

FLORA OF THE LAND OF ISRAEL; Feinbrum, Naomi and Michael Zohari, 15 pages, illustrated. Weizmann Science Press, Jerusalem. 1956. $5.00.

The first two editions in this series (pls. 1-50, and pls. 51-100) appeared as folders containing loose plates. They are now published as books with Hebrew and English texts in each volume. The third volume (pls. 101-150) contains an English text only, arranged according to the alphabetic order of Latin names. The small country of Israel, with an unfavorable climate in many of its regions, yields about two thousand plant species of which fifty are shown in this book. There are five color plates; the remainder comprise excellent drawings in life size of entire plants, floral parts, fruits, and seeds. The choice of plants in this volume appears to be determined by their showiness and frequency of occurrence. The book is, therefore, primarily of value to the casual botanist roaming the barren hills. Additional volumes are in preparation. HERMAN F. BECKER

A Guide for The Haleakala Section [Hawaii National Park]. Ruhle, George C. 100 pages, illustrated. Hawaii Natural History Association, Hawaii National Park, Hawaii. 1959. $1.00.

With special interest focused on our fiftieth State, more visitors than ever will flock to Hawaii National Park this winter to escape inclement weather on the mainland. Dr. George C. Ruhle's *A Guide for the Haleakala Section* of this Park is timely. This booklet, bound in a glossy cover showing the endemic silversword (*Argyroxiphium sandwicense* DC.) in color, devotes fifteen pages to a general introduction to the region with suggested hiking trips; the following thirty-two pages are devoted to Haleakala Hawaiiana, historical background and geology. The next thirty-three pages describe the plants, almost all endemic to the Islands. The remaining eleven pages are devoted to birds, mammals, and insects; and chiefly to Hawaiian words and place names. This Guide, illustrated with photographs and drawings mostly of plants, is indispensable for visitors to this rugged and magnificent region, easily accessible from a comfortable observatory thanks to an auto road that reaches Kolekole Summit at 10,025 feet elevation.

OTTO DEGENER
Waialuo, Oahu, Hawaii

DICTIONARY OF WORD ROOTS AND COMBINING FORMS. Borror, Donald J. 134 pages. N-P Publications, Palo Alto, California. 1960. $2.00.

Dr. Borror, who is Professor in the Department of Zoology and Entomology of Ohio State University, has given us a remarkable compilation of words and fragments of words used in the biological sciences. It is the more unfortunate that the work is pervaded by an unfortunate misconception of the nature of "roots." His "roots" are stems (even botanists have made the same mistake), and this apparently minor technical error leads to a certain amount of confusion. The stem rhachi- is correctly listed (but only the zoological meaning is given), while rhachia-(surf) is also included as "rhachi," as if it were the same word. "Soli," "solo," and "solu" are all listed with the meaning "alone." The last of these I do not know; but the others, and solum also, which might as well have been included, are merely inflectional forms of the same word. Calyx is so given, and the stem calyc-, from which several other words are formed, is not listed; the meaning given is simply "calyx," not the primary meaning of "covering." The two words "carp" (carpo-) are perhaps derived from the same root. And so on, throughout the book.

Errors seem very few ("novaboracens" instead of noveboracensis), and even with the above infelicity of concept the book may be of use to students. But, when all is said and done, would it not be as easy to learn the use of Latin and Greek lexicons?

H. W. RICKETT

BOTANY—A Textbook for Colleges. Popp, Henry W. and Alvin R. Grove Jr. 3rd Ed. 571 pages, illustrated, indexed. McGraw-Hill Book Co., New York, N. Y. 1960. $8.95.

This third edition of a well-known textbook is largely rewritten, rearranged, and even more sumptuously illustrated. Discussions of such topics as growth substances and viruses are expanded, and a more up-to-date system of classification is adopted. The old chapter on "Families of Angiosperms" is omitted. Errors in the treatment of inflorescences and of nomenclature are retained.

H. W. RICKETT

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PRINCIPLES OF PLANT BREEDING. Allard, R. W. 485 pages, illustrated, indexed. John Wiley & Sons, Inc. New York, N. Y. 1960. $9.00.

This book, by a Professor of Agronomy at Davis, California, is naturally aimed at the student of agriculture. The emphasis is upon methods and results of breeding and selection in crop plants rather than upon principles of heredity as such. However, most aspects of inheritance are treated in considerable technical detail.

H. W. RICKETT

AQUATIC PHYCOMYCETES. Sparrow Jr., Frederick K. 2nd Ed. 1187 pages, illustrated, indexed. University of Michigan Press, Ann Arbor, Mich. July 1960. $22.50.

The second edition of *Aquatic Phycomycetes* is an up-to-date and much-enlarged revision of the book first published in 1943. It is a scholarly presentation of all the microscopic phycomycetous fungi which occur in fresh and marine waters. In addition to the inclusion of species and genera of aquatic phycomyetes described since the first edition, species of *Pythium* and *Phytophthora* that are known to exist in an aquatic habitat, the genera of *Saprolegniaceae*, the desmid parasites belonging to the genus *Ancylistes*, and the species of *Physoderma* parasitic on march and aquatic vascular plants are included.

The book includes technical diagnoses of 10 orders, 24 families, 152 genera and 781 species and is illustrated with 929 line drawings. An index of substrata, a bibliography of over 2500 entries and a general index complete the volume.

CLARK T. ROGERSON

HANDBOOK OF MICROBIOLOGY. Jacobs, Morris B., and Maurice J. Gerstein. 322 pages. D. Van Nostrand Company, Inc., Princeton, N. J. 1960. $8.50.

This text is intended to provide practical information most commonly sought in the course of microbiological laboratory routine and research that ordinarily would require reference to many texts and periodicals. It includes descriptions of culture media, stains, simple keys for identifying the most important microbes, and various tables relating to pathogens, tests, reagents, and numerical data relating to dilution and temperature. This book should be of great value to students as well as professionals.

ANNETTE HERVEY

A GUIDE TO THE IDENTIFICATION OF THE GENERA OF BACTERIA. Skerman, V.B.D. 217 pages, illustrated, indexed. The Williams and Wilkins Company, Baltimore, Md. 1959. $5.50.

The key to the genera of bacteria is based on data given in the seventh edition of Bergey's *Manual of Derminative Bacteriology* and on several original papers. The author hopes that the general application of the methods for study described will lead to a greater uniformity in descriptions at the generic level. Thirty-one

(Continued on page 35)

NEWS, NOTES and COMMENTS

Activities of the Staff and Director. Within recent months, Dr. William C. Steere, Director, attended a meeting of the National Science Foundation in Washington, D. C., to consider awarding grants for research to teachers in colleges and universities on an institutional rather than on an individual basis; the dedication of the new building of *Biological Abstracts* in Philadelphia, at which he spoke on "Communications in Biology"; a meeting of the American Committee of the International Union of Biological Sciences in Washington, D. C.; and the formal organization of the Association of New York State Museums in Albany, New York. Dr. Steere, accompanied by several of the Garden's staff members, visited the Brooklyn Botanic Garden. He also visited the Missouri Botanical Garden, St. Louis, where he discussed botanical problems with the Director, Dr. Frits W. Went, and the Los Angeles State and County Arboretum at the request of the National Science Foundation. He addressed the Northeastern Zone meeting of the Garden Club of America at Millbrook, New York; spoke at the banquet that followed the dedication of the new herbarium facilities at the State Museum, Albany; talked on "Flowering Plants of the Arctic" to the teachers in the In-Service Course under the Garden's Educational Program; participated in a meeting at Tucumán, Argentina, and a field trip to tropical and subtropical areas at the invitation of the Botanical Society of Argentina. from November 27-December 4, 1960, and visited botanical gardens at São Paulo, Rio de Janeiro, and Montevideo.

Dr. Harold W. Rickett, Bibliographer and Acting Assistant Director (Botany), and Dr. F. A. Stafleu of the University of Utrecht have completed work on the list of conserved and rejected names of *Spermatophyta.* The study was begun by Dr. Stafleu several years ago, but it became evident that it was too great a task for one person to do alone, in addition to his regular work. A grant received from the National Science Foundation early in 1958 enabled Dr. Rickett and Dr. Stafleu to spend several weeks that summer in collaboration at the University of Utrecht and in the Botany Department of the British Museum. Dr. Stafleu then visited the United States in December 1958 for further consultation with Dr. Rickett. They completed verification of almost every citation and evaluation of every conservation and rejection, according to the present rules of nomenclature. The results of their work have been published in *Taxon,* Vol. VIII, Nos. 7, 8, 9, and Vol. IX, Nos. 3. 4, 5.

Dr. Rickett went to Utrecht this past summer to confer with Dr. Stafleu on the extensive bibliography. This will be published in *Taxon* in 1961.

T. H. Everett, Assistant Director (Horticulture) and Curator of Education, was informed by the committee in charge of the Eastern Trial Grounds of the American Dahlia Society, which was established at the Garden last year, that it was well satisfied with the maintenance of the Trial Grounds and the number of people who visited it. Forty members of the American Dahlia Society inspected the Trial Grounds on October 9, 1960, and lunched at the Snuff Mill.

Dr. Bassett Maguire, Head Curator and Coordinator of Tropical Research, returned the first week in October from an extended expedition in South America which began in May 1960. He and Mrs. Maguire spent some time in British Guiana, where they left Dr. Stephen S. Tillett, Research Associate, and Mrs. Tillett in the field, and continued their journey to Belém, Brazil. There they joined forces with Dr. Murça Pires, Chief of the Botanical Section at the Instituto Agronômico do Norte, and Dr. Walter Egler, Director of the Museu Goeldi at Belém, and started work on the two-to-three-year exploration of the southernmost part of Guiana. After they were joined by Dr. Howard Irwin, Research Associate, and Lubbert Westra, graduate student, they went into the region of the Oiapogue River, which flows between British and French Guianas. Dr. Irwin and Mr. Westra remained in that region to collect specimens. Dr. and Mrs. Maguire then went to the sandstone region of central Brazil. Their return to the Garden was delayed ten days because of difficulty in getting transportation. Dr. Irwin and Mr. Westra returned to the Garden the middle of November, and Dr. and Mrs. Tillett on Thanksgiving Day.

Dr. Maguire was elected honorary member of the Sociedad Venezolana de Ciencias Naturales, Caracas, Venezuela, on September 21, 1960, because of his extensive explorations, over many years, of the great Roraima-type mountains of the Guayana Highlands.

Dr. Arthur Cronquist, Curator, has completed the index to his book, *Introductory Botany,* which will be published by Harper and Bros. in February or March, 1961. Dr. Cronquist attended a meeting in Washington, D. C., which was concerned with planning the 1961 Summer Institutes for high school students under the sponsorship of the National Science Foundation; and gave a talk on "The Relationship of Evolutionary Mechanisms and Angiosperm Taxonomy" before the Botany Department of the University of Southern Florida on the way back from his plant collecting trip to Costa Rica.

Dr. David J. Rogers, Curator of Economic Botany, conferred with Dr. Edgar Anderson at Wesleyan College, Middletown, Conn., where Dr. Anderson is a fellow in research this year, and spent two days at Harvard University's Botanical Museum. Dr. Rogers has been appointed trustee by Dr. Steere to represent The New York Botanical Garden as a participating member in the Bio-Mathematical Center in New York City. He received acceptance from Prof. Dr. Peter M. Zhukovsky, Director of the Institute of Plant Industry in Leningrad, of the invitation to contribute an article to *Economic Botany.* Dr. Rogers arranged the symposium on "Machine Methods in Biology" in Section G of the meetings of the American Association for the Advancement of Science in New York City, December 26-30. 1960. It was held in the Hotel Biltmore on December 30, and the following presented papers: Dr. Rogers on "Computer Simulation of Taxonomic Methods"; Dr. T. T. Tanimoto, International Business Machines, Research Division, on "Applications—Processing of Non-Numerical Data"; Dr. Robert R. Sokal, University of Kansas, on "Use of Computers in Systematic and Other Zoological Research"; Dr. Leonard Ornstein, Mt. Sinai Hospital, on "Pattern Recognition, Morphology and Generation of Hypothesis." Dr. D. D. Welk of the National Research Council presided at the symposium.

Dr. Richard M. Klein, Alfred H. Caspary Curator, has received a grant of $20,600 from the National Science Foundation for the support of basic research on "Interaction of Ultraviolet and Visible Radiation on Plant Growth." The grant is in effect until October 1963.

Dr. P. P. Pirone, Plant Pathologist, addressed the Northeastern Zone meeting of the Garden Club of America at Millbrook, New York, on "New Chemical Aids to Gardening" and the Northern New Jersey Metropolitan Nurserymen's Association on "Controlling Diseases of Nursery Stock." He is presently engaged in investigating an ailment—a form of leaf scorch—on *Gingko biloba* in New York City. Dr. Pirone recently completed minor revisions on Pirone, Dodge, and Rickett: *Diseases and Pests of Ornamentals,* third edition, to be reprinted by the Ronald Press Company. Published in March 1960, the first printing of the third edition has been sold out.

Dr. Clark T. Rogerson, Curator of the Cryptogamic Herbarium, participated in the Charles Horton Peck annual foray at Paul Smith's College, Paul Smith, New York; also in the symposium on "Botanical Exploration in New York State," held in connection with the dedication of the new herbarium facilities of the State Museum at Albany; spent a week in research at the Highlands Biological Laboratory near Highlands, North Carolina, and collected fungi in the area.

Mrs. Mary Fleming, Technical Assistant in the Cryptogamic Herbarium, lectured before the teachers in the In-Service Course; her subject was "Flowering Plants in the Home Garden." Mrs. Fleming was elected a director of the New York Chapter of the American Rhododendron Society, and Vice-President of the New Jersey Chapter of the Society.

Miss Elizabeth Hall, Sarah Gildersleeve Fife Memorial Librarian, talked on "Flower Prints and Other Illustrations" before the teachers in the In-Service Course at the Garden; visited St. Barnabas Hospital, New York City, where she told patients about some of the amusing telephone calls that come to the Library; was guest at dinner at the Old Ladies Home in the Bronx, where she gave the illustrated talk on "Plants of the Bible."

Dorothy Ebel Hansell, Editor of *The Garden Journal,* attended a breakfast at the Hotel Pierre, New York City, which marked the fiftieth anniversary of the Gilson Manufacturing Co. of Plymouth, Wisconsin, and its entry in the garden tractor field with "Gilson Pacer," a compact, rear-engine model designed by the noted industrial designer Brooks Stevens; a breakfast at the Tavern on the Green in Central Park, New York City, at which "Lawn-Boy Hobby Gardener" and other models of power lawn mowers were shown to representatives of the press, garden writers, and others by OMC Engines and Equipment Division of the Outboard Marine Corp. of Waukegan, Illi-

nois. Moto-Mower Co. of Richmond, Indiana, also entertained a similar group at the Tavern on the Green to whom it showed power lawn mowers, garden tillers, and other power garden tools. Mrs. Hansell attended the fall flower show of the Horticultural Society of New York; the showing of the new film "Magic Carpet of Holland," which will be distributed by the Holland Bulb Growers Association; and the lecture on "Color and Art in Flowers" given by The Garden Club of America at the Metropolitan Museum of Art. She has been appointed a member of the Committee on Publicity for the American Association of Botanic Gardens and Arboretums, of which Dr. William Longenecker, Executive Director of the University of Wisconsin Arboretum and Wildlife Refuge, is the chairman.

Staff Seminars. On October 27, 1960, Dr. Herman Becker, Visiting Research Associate of The New York Botanical Garden, gave an illustrated lecture on the Hebrew University at Jerusalem and the Negev; on November 18, 1960, Dr. Rudolph M. Schuster, Professor of Botany at the University of Massachusetts, discussed "Botanical Investigations in the High Arctic of Greenland and Ellesmere Island."

Gifts to the Garden. John F. Rollins, of Scarsdale, New York, gave a collection of orchids, mostly cattleya hybrids; A. Sumner Gambee of Englewood, New Jersey, a power lawn sweeper; Mrs. Anthony Reinach of Scarsdale, New York, a greenhouse; Earl Morse of New York City, a collection of Saunders tree and herbaceous peonies.

Gifts to the Library. Two volumes of microfilms were received from Mulford Martin, one of a seventeenth-century garden book, *The Twelve Months*, by Matthew Stevenson, the other a modern Russian textbook on plant morphology. A descriptive manuscript on scenes and wildflowers of Australia, entitled "Gardens of Nature," by the late Rev. H. B. Rupp of New South Wales, was presented by his son Arthur through Miss Carol Woodward. Rev. Rupp, who was an honorary member of the staff of the New South Wales National Herbarium, died several months ago at the age of eighty-seven. "Practically all his works and collection are now in the National Herbarium in Sydney," his son informed Miss Woodward. The remainder [is] with the University of New England in Armidale, New South Wales." Rev. Rupp contributed an article to the July 1946 issue of *The Journal of The New York Botanical Garden* on "Something About Australian Orchids," the first of a projected series on the flora of New South Wales.

Dr. George S. Avery, Director, and several members of the staff of the Brooklyn Botanic Garden, Brooklyn, New York, visited The New York Botanical Garden recently, lunched with Dr. Steere and members of the Garden's staff, and discussed matters of mutual interest.

Vincent J. Granger died at his home in New York City on November 26, 1960, at the age of seventy-eight. A native of Dublin, Ireland, he came to the United States about 1910. As a young man he was employed by Charles Broadway Rouss, and it was during these years that he developed life-long interest in geography and botany. His love for plants brought him to The New York Botanical Garden in October, 1940, where he was employed as a helper until 1956. He became Senior Attendant and served as such until his retirement in September, 1959.

He is survived by his daughter Alice and his nephew Edward McGuire, who has been an employee of the Garden for twenty-three years.

Dr. Stanley A. Cain, Chairman of the Department of Conservation, University of Michigan, has been appointed to a six-year term on the Advisory Board on National Parks, Historic Sites, Buildings, and Monuments by Secretary of the Interior Fred A. Seaton. Dr. Cain is active in the Botanical Society of America, Ecological Society of America, and other organizations. Dr. Cain spent several months at the Garden late in 1940 and early in 1941, in research on a book on ecology which he was preparing under a fellowship from the Guggenheim Foundation.

Visitors to the Garden. Within recent months the following have visited The New York Botanical Garden:

Dr. Maria Buchinger, Dirección de Investigaciones Forestales, Buenos Aires, Argentina.
Mrs. Rose Rabin, Bondi Beach, Sydney, Australia.
Miss Margaret Eadie, Larbart, Scotland.
Otway A. Prevatt, Industrial Development Commission, Trinidad.
Dr. E. G. Melville, Vice-President, Zoological Society, Trinidad.
Dr. and Mrs. E. M. Hildebrand, Chevy Chase, Md.
Dr. Margaret Seikel, Wellesley College, Mass.
Dr. Alexander S. Khokhlov, Institute for the Chemistry of Natural Compounds, Moscow, U.S.S.R.
Dr. S. N. Valenju, Bombay, India, and Vermont.
Drs. Karl Folkers, Carl Hoffman, H. Boyd Woodruff, and A. C. Page, Merck and Co., Rahway, N. J.
Reginald Perry, Enfield, Middlesex, England.
Dr. Dwight Gray, Program Director, and Ileen Stewart, Assistant Program Director, for Support of Scientific Publications, National Science Foundation, Washington, D. C.
Dr. John Flynn, Office of Naval Research, New York, N. Y.
Henry F. du Pont, Winterthur, Del.
Frederick S. Moseley Jr., New York, N. Y.
Mrs. John E. Parsons, Harrison, N. Y.
Dr. John A. Scott, Fieldstone School, Riverdale, New York, N. Y.
Alfred B. Graf, Rutherford, N. J.
Mrs. Harriet L. Morse, New York, N. Y.
Mrs. Mortimer J. Fox, Mt. Kisco, N. Y.
Dr. George M. Lawrence, Director, Rachel McMasters Miller Hunt Botanical Library, Pittsburgh, Pa.
Carl Schiff, Horticulturist, Department of Parks, New York, N. Y.

Citations. Two botanists were among the six people upon whom the American Horticul-

This greenhouse, presented by Mrs. Anthony Reinach, has been dismantled and moved from her property in Scarsdale, New York, to The New York Botanical Garden.

tural Society, at the fifteenth annual American Horticultural Congress held in Pasadena, California, November 1960, conferred citations. These were Dr. Karl Sax of the Arnold Arboretum, Jamaica Plain, Massachusetts, who was honored for his investigations in the genetics and cytology of many important genera of woody plants, and for research that has led to practical applications; and Dr. Philip A. Munz, Director Emeritus of the Rancho Santa Ana Botanic Garden, Claremont, California, who received a citation for his contribution to horticulture in California as a teacher, author, and director of the Botanic Gardens.

The four other recipients were Gretchen Harshbarger, Past President of the Garden Writers Association of America and Midwest Garden Editor of *American Home Magazine*, for her practical garden writings; Jacques Legendre of Gulf Stream Nursery, Wachapreague, Virginia, for his services to American horticulture as plantsman and nurseryman and for his keen perception in recognizing the value and usefulness of new selections from western Europe; William Hertrich, Director Emeritus of the Huntington Botanic Gardens, San Marino, California, for his contributions in stimulating interest in camellias and succulent ornamentals for southern California, and in developing the Botanic Gardens; and Mrs. J. Norman Henry of Gladwyn, Pennsylvania, for collecting and evaluating North American plants and for reporting on their value as ornamentals.

The Liberty Hyde Bailey Medal, awarded for the third time, was presented to Dr. H. Harold Hume of Gainesville, Florida, for his important contributions as a leader in ornamental horticulture in the southeastern states; his publications on hollies, camellias, and azaleas are noteworthy.

"The Fifty States of the U.S.A." will be the theme of the Philadelphia Flower Show to be held at the Trade and Convention Center, March 5-11, 1961. The arts and cultures as well as the natural beauties of the geographical areas of the United States will be featured. Mrs. James C. Hornor is Chairman of the Flower Show Committee, Mrs. H. Cameron Morris is Vice-Chairman.

Talinum paniculatum.

The Federal Trade Commission has received an increasing number of complaints about false advertising of bulbs, shrubs, trees, and other nursery products. Earl W. Kintner, Chairman of the Commission, asserted that "although the great majority of persons engaged in the mail-order nursery industry are honest, responsible business men, the malpractice of a few unscrupulous dealers threatens to give the industry a bad name. In order to protect legitimate nurserymen and the public, the staff of the Federal Trade Commission will subject advertising of nursery products to increased scrutiny. A recent source of trouble for the Commission has been false advertising about the rate of growth, shade afforded, and general attractiveness of the ailanthus or tree of heaven, and about the 'climbing peach vine.' The latter, a relative of the melon, produces a hard gourd-like fruit which is not edible except in preserves. In them it is used like watermelon-rind."

Sherman R. Hill, Director of F T C Bureau of Investigation, suggests that consumers check with Better Business Bureau or other reliable sources on the reputation of an unknown firm which makes exaggerated statements in its advertisements; seek advice from county agricultural agents, horticultural references in libraries, and local nurserymen on whether the particular plant is adapted to the use for which it is advertised; examine carefully claims of "tremendous bargains"; and pay particular attention to advertised guarantees.

1961 Plant Offerings. Coleus 'Chartreuse' is being introduced by the Geo. W. Park Seed Co. of Greenwood, South Carolina, as a fine bedding plant in sun or shade and as a nice pot plant in the home during winter. It is a pleasing chartreuse color in early summer and in midsummer and autumn, when grown in full sun, a light golden color. The plant is dwarf and bushy and by a little "topping" may be held to twelve inches or so in height.

Another Park presentation for 1961 is *Talinum paniculatum*. This perennial is not new to horticulture, but it is not generally available. Geo. W. Park's trial-ground planting was so impressive that they deemed *T. paniculatum* worthy of being brought to the attention of gardeners. The foliage is a bright waxy green and forms a nice foil for the airy panicle of flowers borne on stems which rise a foot and a half above the foliage. The small cameo-pink flowers are produced so generously that they create an effect of pink haze. *T. paniculatum* is easily grown from seed; it withstands summer heat, even the moist humid conditions of the Southeast.

Clematis 'Mrs. P.T. James' (plant patent applied for) is one of the new or little-known plants which Wayside Gardens of Mentor, Ohio, will introduce this spring. It is a robust climber with a profusion of large double blue flowers on well-established plants. The pointed petals give the effect of an exploding star. Phlox 'Star Fire' (plant patent applied for) has vivid red flowers and fine green foliage on a plant two to three

Coleus 'Chartreuse'

Phlox 'Starfire'

feet high. There are from six to a dozen stems on a well-grown specimen. Wayside Gardens are importing several new varieties of phlox, raised by the late Captain Symons-Jeune of England, for introduction to American gardens in 1961; a selection of hardy asters (*A. novi-belgii*) 'Fontaine', 'Lassie', 'The Sexton', and 'Tudor-Rose', which have been developed in England; and they offer the de Rothschild Supreme Selection of azaleas, which they exhibited at the Boston Flower Show last March. The broad-petaled flowers, as much as four inches across, range in color from pure white through delicate pastels to deep yellows, bright orange, and fiery reds.

All-American Mum Selections for 1961 are 'Her Majesty', slightly incurved white decorative; 'Bingo', a dark red cushion; and 'Apricot Sheen', a cactus-flowered cushion mum.

All-American Gladiolus Selections for 1961 are 'Rusty', a Canadian origination and the first All-American "smoky", in color a chocolate-red; 'Gypsy Dancer', a Carl Fischer origination in scarlet-orange with yellow on the lower petals; and 'China Blue', also by Carl Fischer. The color of the last is a soft blue-violet, deeper at the petal tips, then lighter near the center where a deep violet blotch accents the lower petals.

All-American Gladiolus Selections Inc. has forty-six trial gardens in the United States and Canada which test new seedlings from all over the North American continent.

All-America Camellias 1961. All-America Camellia Selections announce two award winners for 1961. *Camellia japonica* 'King's Ransom' has pale pink blooms averaging four and a half inches across; the color deepens rather than fades with age. It is an early-blooming variety. 'Bonnie Marie' bears profusely its four-to-five-inch flowers of a delicate phlox-pink. Early blooms are semi-double; later, more typical ones are anemone-like. This cultivar, the result of a selected clone (*C. saluensis* × *C. cuspidata* × *C. japonica*) has withstood temperatures of 10° below zero, and in the San Francisco, California, area, has bloomed from mid-November through April.

Clements 'Mrs. P. T. James'

DR. B. O. DODGE (from page 24)

ample for those of us whose faith falters! In 1920 Dodge discovered heterothallism in ascomycetes, using *Ascobolus magnificus,* a new species described by him. In 1927 he started his genetic studies of *Neurospora,* and it was several years before even he fully appreciated the significance of his findings. The new field of study which he opened up had been anticipated in the work of Blakeslee, Burgeff, Knief, and Brunswick, but probably no other investigator in the field carried through with his energy and drive, or can trace in a direct line so much influence on the work of others.

". . .After his first papers had demonstrated the excellent potentialities of *Neurospora* for genetic investigations, he took his own counsel and, with the aid of the geneticist Carl Lindegren, showed that *Neurospora* obeyed the basic laws of genetics. Dodge's studies on the heredity of fungi were always adventurous, imaginative, and progressive. Indeed, they were largely responsible for the accelerated adoption of microorganisms as research tools which, with refined techniques devised by Beadle, Tatum, and others, has led to the present-day explosive progress in genetic fact and concept.

"Although Dodge considered himself primarily a mycologist, he was able to move from one field to another and retain his capacity for suspended judgment along with an impulse for progress. Designs in nature—the physics of living things—fascinated him. He would bring in pine cones, snail shells, and plant stems and pore over them for months during his spare time, marvelling at the spiral designs in all of them and making sketch after sketch.

"During each of his latter years, Dodge would bring into our laboratories a set of cultures of *Neurospora tetrasperma,* forgetting that he had done so the year before. He would fondly go over each, giving its origin and characteristics, and then would leave them with us, hoping that some one would be interested in taking up where he left off. Some one will, of course. We are

A de Rothschild Supreme Selection azalea

holding them for the use of future students who will be stimulated by his work and the legacy of ideas that he left behind." [Some of Dr. Dodge's cultures are being held at The New York Botanical Garden under the custody of Dr. Annette Hervey.]

Dr. Edward Tatum, Professor at the Rockefeller Institute for Medical Research and a Nobel prize winner, spoke extemporaneously of the significance of Dr. Dodge's research as it applied to biochemical genetics; and Dr. Carl C. Lindedren, of the Department of Microbiology of Southern Illinois University, reminisced about his association with Dr. Lodge.

Dr. Tatum said in part—"Dodge's long career in mycology was characterized throughout by a true love and enthusiasm for his molds. The contributions to which his love and enthusiasm for the fungi led have played a major role in the development of biochemical genetics, although his own researches were not actually in this field. Both as an investigator and as a teacher, his career inspired and will continue to inspire mycologists, microbiologists, and geneticists.

"It is clear from this [a summary of some of Dr. Dodge's work with *Neurospora*] that he was convinced of its versatility and usefulness as a genetic tool, and that he realized fully the basic potentialities of this organism. However, he was well in advance of his time and was almost a lone voice crying in the wilderness for a number of years. . . .Beadle, as a graduate student at Cornell University, heard Dodge lecture on his pet molds. Thomas Hunt Morgan, then at Columbia University, had close contacts with Dodge. He must have been well enough impressed with Dodge's picture of its potentialities to carry a culture of *Neurospora* with him when he moved to the California Institute of Technology in 1928. It was there that Lindegren, on Morgan's advice, undertook his dissertation work on *Neurospora* and studied problems of genetic mechanisms, crossing-over, and related phenomena. As a consequence of the extensive biological and genetic background provided by Dodge and by Lindegren, *Neurospora* was the natural choice for an organism in which to attempt the production of mutations relating to biochemical processes.

"Well before 1941, when Beadle and I undertook our biochemical genetic studies, Dodge had the basic concept and potentialities of *Neuro-*

spora in mind and in many respects his vision permitted him to anticipate later developments. This is shown by the beautifully clear statements in a paper entitled "Some Problems in the Genetics of the Fungi," which was delivered at the Third International Congress in Microbiology in New York in 1939. In this he said: 'The fungi in their reproduction and inheritance follow exactly the same laws that govern these activities in higher plants and animals.'

"...it is not too much to conclude that without Dodge and his vision, insight, and imagination, biochemical genetics via later work with *Neurospora* would not have begun when it did."

FLORAL ART (from page 23)

It was graduation day at the school, and the graduating class had made arrangements of plant material which were placed around the room. The arrangements were simple, but each one had an original slant as, for example, locust seed pods fastened to a vine with three calla lilies massed at the rim of the container.

Kyoto is old Japan; its remarkable heritage of over a thousand years as Japan's imperial capital is still carefully guarded. The gardens are very complex, but nowhere does the art of flower arranging tie in so closely with the art of gardening as it does in Japan. Scale, proportion, unity, and balance are "musts" in both. In the Shugakuin Gardens the art of trimming — a practice followed in flower arranging in Japan as well as in gardening—has reached perfection. I saw hedges of beech trees not more than three feet high, and aged pines trimmed into fantastic shapes. In the Moss Garden there is a remarkable feeling of texture—of velvety texture. No two gardens are similar, nor do they even approach a resemblance to one another; yet all have beautiful proportion and perfect scale and are functional. Green in its many shades and hues is emphasized; there are no disturbing splashes of color.

Shopping in Kyoto was a delightful experience, but old bronze containers and burls which tempt flower arrangers were scarce. The one Seika vase or "usabata" for sale was quickly purchased by a member of our party.

In this city we had the privilege of attending four night classes in Ikenobo College whose origin dates back to the seventh century. We were instructed in the classic style of Ikebana. To my delight I saw a Rikkwa arrangement; it was made by one of the advanced students and was beautiful in every way. The vases for the Rikkwa style do not have double bottoms as do the usabatas; they are open their whole depth to allow considerable lengths of stems to stand in them. The stems are not held together with the forked holders as used in usabatas, but are stuck in rice or straw which is bound into bundles. This particular example of the classic style had been modernized, for it was asymmetrical. Here we learned, too, that "heaven, man, and earth" are a fundamental principle in Japanese flower arrangement which is followed by all schools.

Another great privilege was our visit to the Saga School in the Daikakuji Temple where the present Emperor was enthroned in 1924. We were welcomed by Mrs. Tsujii, wife of the Master, Koshi Tsujii, whom we had met in New York a month earlier. We ate our lunch sitting on tatamis (straw mats) in a room overlooking Owaso Pond. We had already visited many shrines, but this was the only one in which there was a designed flower arrangement. In all the many shrines and temples we visited, the flowers were bunched and tied together and placed on the altars. Occasionally we saw some that had been put in water.

Student priests escorted our party around the mossy gardens and through the abbey which has exquisite accessories; we attended two classes in flower arrangement at the Saga School.

Then came our visit to the famous garden at the Ryoanji Temple, in which sand and rocks are the only elements used to create a picture. No one is permitted to walk in this garden. At first glance it seemed to be no more than a flat expanse of raked sand and groupings of rocks, but further study proved it to be fascinating in conception and execution. The garden is considered perfect in composition and harmony and would be marred, it is thought, if one stone were moved.

Another highlight of our trip to the Orient was a visit to Ito, where we stayed at a pleasant inn, Yonewakso, with a beautiful garden. Although the garden is only a few years old, it has the appearance of having been in existence for centuries. Young spreading pine trees are supported on an elaborate framework of bamboo to train them exactly to the right shape and direction. True scale and proportion give this small garden the feeling of spaciousness, of being much larger than it actually is. Iris, wisterias, and azaleas were blooming at the time of our visit. There was, however, great restraint in the use of plants. Restraint in the use of plants distinguishes their gardens and their arrangements. Restrain is the magic word in Japan, not only in Ikebana and gardening, but in their way of life.

What the future holds for modern Japanese floral art is debatable. Some of the arrangements of the modern school in Japan were fantastic; but they could not have been made without some knowledge of the fundamentals of the classic style, for there was harmony in the whole composition and a relationship between line and container. Where tradition had been cast aside and students given so much freedom that they could not find any more rules to break, the results were extraordinary, as we saw at a flower show in a department store: a few stove pipes put together with a bunch of violets thrust in the hole were one result. In my opinion such "flower arranging" ceases to be art and becomes a craft, and should be separated from true artistic expression, in which plant material is effectively employed. Cut logs, even arranged artfully, do not constitute a flower arrangement.

In Japan both the teacher and student work together to create; this is the impelling force that keeps floral art alive and prevents it from stagnating. Ikebana is more than the art of flower arranging, for it is deeply associated with the philosophy and the way of life of the Japanese, and every arrangement is symbolic. In this country it sometimes seems as though flower arrangers are more concerned about winning "blue ribbons," and where they can use the arrangements in their homes, than they are about artistic expression.

Garden clubs and Ikebana International are thriving in Hong Kong, and they hold competitive shows. Flowers do not bloom abundantly there, because of the scarcity of water, but early spring brings a plentiful supply of calla lilies, peonies, and roses, and these are followed a little later by zinnias.

Thailand is a land of contentment and happiness. In the temples in Bangkok we saw many flower arrangements. Some of them showed an English influence; Queen Victoria, who was intensely interested in this land, sent many gifts of alabaster urns, the decorative flared vases which were used under glass domes and clocks. Fragrant frangipani trees were blooming profusely during our visit, and we noticed marigolds and tuberoses bunched together as floral offerings to Buddha. In the fabulous Siamese home of Jim Thompson, who first set foot in Thailand some fifteen years ago as a colonel in the American Army O.S.S. and is now managing director of the Thai Silk Co., we saw flower arrangements among his art treasures. Many were of rosy pink lotus flowers, whose petals had been incurved by the hands of the English

Five teachers of the Sho-fu School demonstrate Japanese flower arrangement. Mrs. Wheeler, on the left, acts as interpreter. Third and fourth from the left are Mrs. Gensui Kobayashi and Mrs. Sensui Ide, who demonstrated the use of roses in Japanese flower arrangements at The New York Botanical Garden in June, 1959.

hostesses. In the dining room the choice fruits that can be purchased at the floating markets composed a handsome centerpiece. Mr. Thompson's home is a series of old homes furnished with antiques of the Orient. The admission fee is used for the benefits of blind children.

Because of the great heat and lack of rain during the summer months, the growing season around New Delhi and Agra in India is short. However, colorful leis of marigolds were placed around our necks as we stepped off the plane, and little children had gathered wild flowers which they presented to us, saying "Flowers for Madam."

The beauty of the Taj Mahal surpasses anything I have ever seen. Heavy white marble has been transformed into an ethereal edifice—the marble is inlaid with lapis lazuli and carnelian in values of blue and red-orange. The Taj Mahal is situated in a lovely Persian garden where the playing of fountains seemed to cool the air in the intense 112° temperature.

In Istanbul, one of the oldest cities in the world, we came upon the most modern decor—at the Hilton Hotel. Enormous potted hydrangeas decorated the lobby and the terraces, and potted plants of various kinds were hung in marble niches. A beautiful garden, sloping down to the Bosporus, with Asia Minor just across the Straits, was planted with colorful annuals.

Fields of red poppies, asters, and cornflowers in the suburbs of Athens created a memorable picture.

En route to Florence, we drove through farm lands rich in ancient olive trees and grapes. Here again we saw bright red poppies.

In Rotterdam we visited the International Horticultural Exposition. Dr. Carl Wedell, Director General of the "Floriade," who was our host, was assisted by two pretty Dutch girls in blue costumes. I had an overflow audience, not only of adults, but of children for my lecture on Japanese-style flower arrangements.

Mrs. Phillip Young, wife of the American Ambassador to The Netherlands, graciously entertained our group at coffee the next morning at The Hague. This is a beautiful city. White baskets filled with pink geraniums and ivy were strung across the streets in the main shopping areas; the little homes have their tiny gardens; and there are no fences anywhere. Our day was complete with a visit to the Peace Palace and its superb gardens.

Many lessons in the art of gardening and the art of flower arranging are to be learned from many countries. Sometimes these are found in the flower stalls in the midst of cities, sometimes in the fields of wild flowers, sometimes in temples and their gardens.

As a member of The New York Chapter of Ikebana International I participated as an exhibitor at the Ikebana Exhibition held at the Nippon Club in New York City, October 27-29, 1960. This was held under the auspices of the Consulate General of Japan, the New York Chapter of Ikebana International, the Japan Society, the Japanese-American Women's Club, the Nippon Club, and the Oriental Women's Club of New York. The flower arrangements, made by members of the Japanese community of New York and American teachers and students of Ikebana from the metropolitan area, were staged by Genichiro Inoksuma. Mrs. Yoneo Arai, of Greenwich, Conn., a well-known lecturer, gave a demonstration of the Enshu School, Mijiko Mori, a recent graduate of Pratt Institute, and Mrs. T. Uchimura lectured on the Sogetsu School. This is the third Ikebana Exhibition to be held at the Nippon Club. The first two were held in the spring; this one emphasized fall foliage and flowers. The proceeds are turned over to the New York-Tokyo Scholarship Fund.

Appointment to staff. Miss Alice Sircom joined the Garden on December 12 as Staff Associate for Publicity and Promotion. Until recently Miss Sircom was associated with Colonial Williamsburg where since 1954 she had served as a staff writer in the press bureau and public relations department. She had special responsibilities for various annual events including the Antiques Forum, Garden Symposium, and shows at Abby Aldrich Rockefeller Folk Art Collection. Miss Sircom was also a press liaison for visits of Queen Elizabeth II and Prince Philip, Queen Elizabeth the Queen Mother, and heads of other foreign states.

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Formerly she handled publicity and promotion for radio and television outlets. Miss Sircom is a graduate of the Woman's College of the University of North Carolina.

Forests are Maine's greatest natural resources according to the authors of *Timber Resources of Maine*, Roland H. Ferguson and Franklin R. Longwood. The former is a forester-statistician on the staff of the Northeastern Forest Experiment Station at Upper Darby, Pennsylvania; the latter is a research forester in charge of the Station's research center at Bangor, Maine.

The survey shows that Maine, the "Pine Tree State," now, after three hundred and fifty years of forest use, has eighty-seven per cent of its land-area covered by forests. No other state has so large a proportion of forest land. In terms of pulpwood—raw material for the State's largest industry—Maine's forests contain two hundred five million cords in standing trees.

Of all the timber species found in Maine, spruce is the most abundant. It accounts for twenty-two per cent of the total timber volume; balsam-fir is next most plentiful—about twenty per cent of the total. Hardwoods—among them sugar maple, the oaks, birches, beech, aspen, ash—make up about a third of the total volume. In recent years these species have become more important, as new pulping processes have enabled the pulp mills to utilize hardwoods as well as softwoods.

The outlook for Maine's forests is good, the report states, for these forests are growing more than twice as much wood as is being cut, and they could support a considerable expansion of the wood-using industry. However, there are dark spots in the situation. A larger volume of timber—even more than is cut—is lost every year to insects and diseases, and some is lost to fires.

Since less than one per cent of Maine's commercial forest area is in public ownership, it is on privately owned forest land that improvement in forestry is needed. The report describes the various services and agencies through which private owners of forest land can obtain assistance.

The Timber Resources of Maine contains detailed statistics on forest areas, volumes of sawtimber and pulpwood trees, rate of growth, volumes cut, forest ownership, distribution of the major tree species, and the condition of Maine's forests in relation to the State's economy. Copies of this seventy-five page illustrated report may be obtained from the Forest Commissioner, Maine Forest Service, Augusta, Maine; or from the Director, Northeastern Forest Experiment Station, 102 Motors Avenue, Upper Darby, Pennsylvania.

BOOK REVIEWS (from page 28)

plates, each containing four to six photomicrographs from slide cultures are included as an aid in the interpretation of the keys.

One practical advantage of this book is that it is easily portable.

ANNETTE HERVEY

CHEMICAL AND NATURAL CONTROL OF PESTS. E. R. De Ong. 244 pages, illustrated, indexed. Reinhold Publishing Corp. New York. 1960. $7.50.

This book covers both natural and chemical control of plant and animal pests—an unusual combination. Under the former are included predators, parasites, and diseases of insects. The major part deals with chemical control of insects, diseases, and weeds in field crops, in orchards, vineyards, vegetable crops, and in ornamental plantings, including lawns. The last few chapters describe pests of livestock, household, and stored products, and how to control them.

P. P. PIRONE

VEGETABLE DISEASES AND THEIR CONTROL. Charles Chupp and Arden F. Sherf. 693 pages, indexed, illustrated. The Ronald Press Co., New York. 1960. $12.00.

Thirty-five years after he wrote his first book on vegetable diseases, Charles Chupp, Professor Emeritus at Cornell University, and a world authority on the subject, has written, with the help of Prof. Arden Sherf, another outstanding book. This book is accurate, up-to-date, and practical. It will be useful to backyard gardeners and commercial vegetable growers, as well as to faculty members and students interested in vegetable diseases. The selected references listed after each section should be especially helpful to the latter. About 170 photographs and drawings further enhance the book's value.

P. P. PIRONE

BIOLOGICAL AND CHEMICAL CONTROL OF PLANT AND ANIMAL PESTS. L. P. Reitz, Ed. 273 pages, illustrated, indexed. Publ. 61. Am. Assoc. Advancement of Science. Washington, D. C. 1960. $5.75.

Nineteen American scientists presented papers on biological and chemical control of animal pests at the December 1957 meeting of the American Association for the Advancement of Science in Indianapolis. These are placed under three categories: the public's stake in pest control, recent advances in chemical control, and biological control of pests. The book is too technical for amateur gardeners, but satisfactory for teachers and graduate students in the several fields that are treated.

P. P. PIRONE

METHODS OF BIOCHEMICAL ANALYSIS, Vol. 8. D. Glick, Ed. Interscience Publishers Inc., New York. ix—400 pp. 1960. $10.00.

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During the last decade, the use of physical and chemical techniques have become the rule in virtually all research laboratories. In addition to the expense of such equipment (a factor in the accelerated aging of administrators) the methodology and techniques required to exploit these exciting new concepts are difficult to obtain. Biologists are particularly prone to such problems because it has become increasingly difficult to keep abreast of concepts and results, much less the experimental innovations and technical methods needed for the research.

For these reasons, the initiation of a series of "how to" volumes is particularly welcome. Prof. David Glick of the University of Minnesota, a pioneer in biochemical and biophysical analysis, has assumed the awesome responsibility of editing a review periodical. The series has contained authoritative articles on microbiological, physical, chemical, and bioassays for a wide range of biologically important cell constituents. "Do it yourself" papers on instrumentation and laboratory procedures round out the selection. The present volume, dealing with fatty acids, hormones, porphyrins, and other substances, will undoubtedly be as welcome and as useful as are the previous volumes.

RICHARD M. KLEIN

NUCLEOPROTEINS. R. Stoops, Ed. 364 pages. Interscience Publishers, Inc., New York. 1960. $10.50.

The proceedings of the eleventh Solvay Conference on Chemistry, held in Brussels in June 1959, have been prepared as a book. Ten distinguished biochemists have contributed chapters on various aspects of the chemistry of information bearing macromolecules. Of special interest is a chapter on the synthesis of nucleic acids in cell-free systems by Prof. S. Ochoa—a research project which won him a Nobel Prize last year. RICHARD M. KLEIN

TREES, SHRUBS AND VINES; Viertel, Arthur T. Without pagination, illustrated, indexed by plant numbers. State University College of Forestry, Syracuse, N. Y. 1960. $1.25.

About six hundred common species of woody plants (exclusive of conifers) native or cultivated in the northeastern United States are illustrated (chiefly the leaves) and described in an artificial sequence based on leaf form. The book is directed to the general public, and technical terminology is held to a minimum.

ARTHUR CRONQUIST

DRAWINGS OF BRITISH PLANTS. PART XIV ADOXACEAE. Ross Craig, Stella. 38 plates, indexed. G. Bell & Sons Ltd. London. 1960. $1.50.

The work consists of a series of accurate, beautifully-done line drawings, with color notes, continuing the high standard of previous parts of the series.

ARTHUR CRONQUIST

THE ANATOMY OF PLANTS. Font Quer, P. 128 Pages. Illustrated, indexed. Harper & Bros., New York, N. Y. 1960. $2.25.

This little book is one of a series entitled "Science Today." It is translated from the Spanish, the author being Professor of Botany at the University of Barcelona. Its six chapters embrace cell structure, histology, and external morphology, besides anatomy proper. It is well illustrated by numerous pen-and-ink drawings. Though apparently designed for general reading, its usefulness will probably be as a text in schools. H. W. RICKETT

HOUSE PLANTS. Better Homes and Gardens (Editors). 160 pages, illustrated, indexed. Meredith Publishing Co., Des Moines, Iowa. 1959. $2.95.

The simplicity in giving basic information on how to care for house plants, as well as their use to enhance the beauty of different rooms, and the excellent pictures, both colored and black and white, make this truly a book worth having for reference. The introduction given by the Editors of *Better Homes and Gardens* on page 5 is excellent.

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Pompton Lakes, New Jersey

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LETTERS TO EDITOR

After the meeting in mid-August in Knoxville, Tennessee, of the Northern Nut Growers Association, I did some further exploration for *Hydrangea* and other plants in the Southeast. I found *H. arborescens* at elevations of sixty-four hundred and sixty-five hundred feet near the top of Chingman's Dome in the Smoky Mountains (Swain County, North Carolina) which corroborated the collection at six thousand feet on Mt. Mitchell.

Dr. James Hardin, Botanist at North Carolina State College, has recently found a spectacular form of *H. radiata* in Transylvania County, North Carolina, which the University will try to introduce into cultivation. Its ray flowers reach two and a quarter inches in diameter. This species, found along streams in the Blue Ridge in an area including the corner of the Carolinas with Georgia, is like *H. arbore-*

scens in most respects, except that the lower leaf surfaces are silvery pubescent. Elizabeth McClintock (about 1951) called it a subspecies of *H. arborescens,* but Dr. Hardin considers it a valid species.

My father Thomas A. McDaniel filled me in on the history of the (nearly?) all-showy-flowered form of *H. quercifolia* found in Etowah County, Alabama, which I expect to introduce as the cultivar 'Harmony'. (Three nurseries now have cuttings.) When he was twelve years old, around 1893, he found a bush with "snowball" flowers in the woods on the family farm. He transplanted it to the homeyard, where it flourished for some ten years. Then it disappeared, or died out, only to be rediscovered (or one like it) by me early this year in the Old Harmony Churchyard about two miles distant.

Now that greenwood cuttings of *H. quercifolia* can be rooted quickly under mist propagation, this and other superior forms of the oakleaf hydrangea can be made available for general cultivation without waiting too long.

JOSEPH C. MCDANIEL
Department of Horticulture
University of Illinois
Urbana, Illinois

I have just seen my letter to Dr. Rickett about the allusion in Willa Cather's novel about substitution in botany, in *The Garden Journal.*

Much to my shame I have given you the wrong novel. The allusion appears in *The Professor's House* (Book 2, Chapter 1).

I hope this hasn't caused any embarrassment.

JOHN MABCH
Willa Cather Pioneer Memorial
New York, N. Y.

The Editor's "face is red." She should have checked the book title.

I enjoyed Paul Arnold's excellent article in the November-December [1960] issue of *The Garden Journal.* It indicates a lot of research.

Since he obtained information from me, I have successfully backcrossed *Gloxinera* 'Longiflora' with *Sinningia eumorpha.* I raised only one seedling to maturity, but it was intermediate, except that the corolla formation more closely resembled *S. eumorpha* and had a delicate blush-pink coloration. The backcross to *Rechsteineria cardinalis* was also intermediate, but the corolla change from the regular form obtained in the × *Gloxinera* did not approach the *R. cardinalis* helmet shape to as noticeable a degree. In color the range went from light red to orange. Although my observations are based on very limited populations, I am convinced that *S. eumorpha* might be allied with *Rechsteineria.* The original cross produced a regular corolla with a five-part limb, but I believe the pouch and white color of *Eumorpha* will be dominant in future hybridizing.

The × *Gloxinera* appears to be a very willing parent. I have crossed it with *R. leucotricha* to incorporate the tomentose characteristic of the latter with a reduction in flower size of approximately one half.

There are many possibilities for further hybridizing with × *Gloxinera,* and I have quite a few seeds sown.

CORNELIUS ACKERSON
Keyport, New Jersey

PRELIMINARY ANNOUNCEMENT

MEMBERS' EVENING

TUESDAY, FEBRUARY 28, 1961

T. H. Everett, *Program Chairman*

WHERE: Essex House
160 Central Park South
New York City

WHEN: Informal Reception 8:00 o'clock

Formal Program begins 8:15 o'clock promptly

WHAT: "The Broad Function of the Modern Botanical Garden" — An address by Dr. Frits W. Went, Director of the Missouri Botanical Garden

"A Bug's View of Nature" — An outstanding film presentation with comments by its producer, the noted photographer, Mr. H. I. Williams

Refreshments

HOW: All members will receive invitations in late January and will be asked to request one or two tickets by return mail.

Two Winter Courses
At The New York Botanical Garden

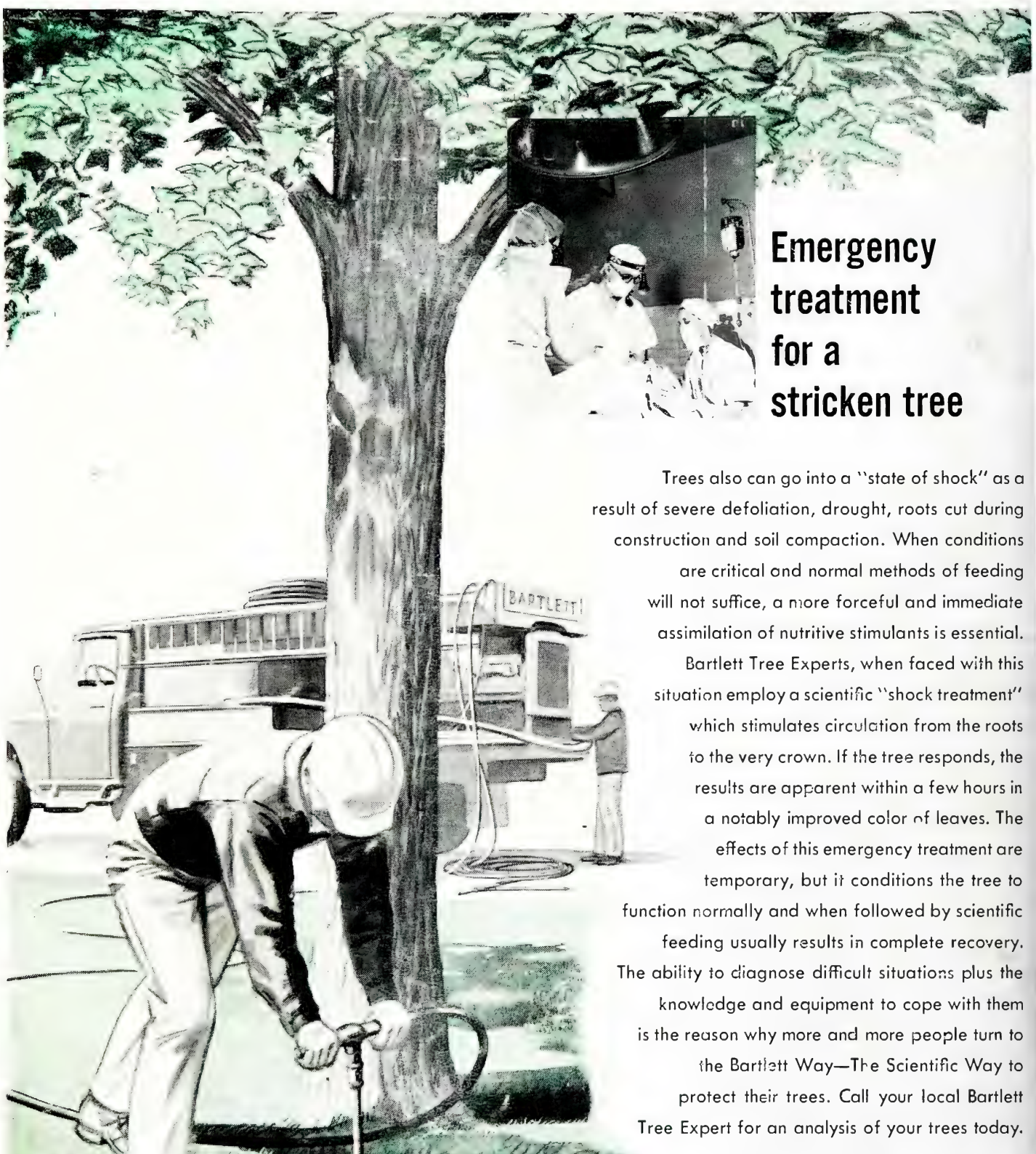
Anyone who grows plants soon learns the importance of identifying plant pests and diseases, understanding them, and learning the best control methods known. Dr. P. P. Pirone will be the very able instructor of classes in PLANT PESTS AND DISEASES beginning on January 12, 1961. His teaching and writing serve as valuable guides to American horticulturists, and his up-to-date recommendations for dealing with pathological problems are always in demand.

This course consists of twelve Thursday sessions, with choice of morning classes (10-noon), or evening classes (8-9). Classes will be held in the seminar room of the Research Laboratory at The New York Botanical Garden. The registration fee is $15.00, with a special price of $11.25 for members of The Garden.

PLANNING THE HOME GROUNDS offers a very unusual opportunity to learn the fundamentals of landscape design, and how to proceed in making the most of one's own property. The instructor will be Arthur Murphy, a landscape architect of broad experience who is particularly well qualified to suggest solutions to the homeowners' landscape problems. Rightly, he begins by assisting students to map their own property, and proceeds by giving individual attention to the working-out of a practical plan for either new planting or improving one which is already established.

For this popular course, advance registration is requested. The course, beginning on January 17, 1961, is scheduled for eight Thursdays (10:30 a.m.-12:30 p.m. or 8-10 p.m.) in the seminar room of the Research Laboratory. The regular registration fee is $25.00—but only $18.75 for members.

THE NEW YORK BOTANICAL GARDEN
Bronx Park, New York 58, N. Y. (Phone LU 4-8500)



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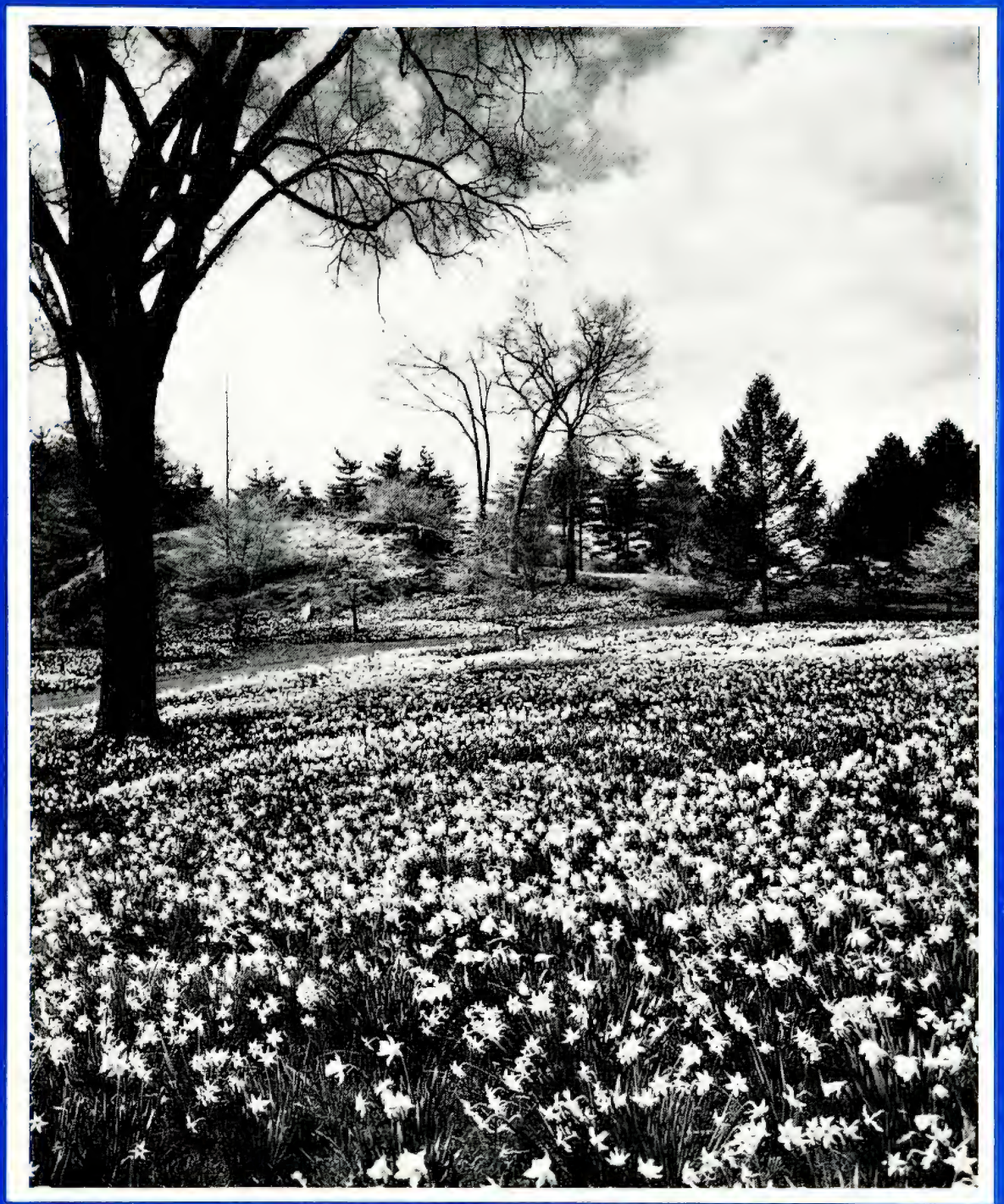

THE GARDEN JOURNAL

THE NEW YORK BOTANICAL GARDEN

Vol. 11, No. 2 March-April, 1961

THE GARDEN JOURNAL

THE NEW YORK BOTANICAL GARDEN

DOROTHY EBEL HANSELL
Editor

In this issue emphasis is placed on various facets of the work of The New York Botanical Garden in articles contributed by the Director and members of the staff.

The eight pages in the center (53-60), "Guide to Trees," are the first installment of a series under this title. They may be removed if the reader desires. The entire series will be reprinted separately.

CALENDAR

April 18-28, 1961. Third International Rock Garden Conference arranged jointly by Alpine Garden Society in London, with cooperation of the Royal Horticultural Society, and Scottish Rock Garden Club in Edinburgh, with cooperation of Regius Keeper, Royal Botanic Garden, Edinburgh.

April 22-29, 1961. Twenty-eighth annual Historic Garden Week in Virginia.

April 26, 27, 1961. Gramercy Park Association Annual Flower Show at the National Arts Club, 15 Gramercy Park, South, New York, N. Y.

April 28-June 15, 1961. Fiorio del Mondo a Torino, Valentino Exhibition Palace and Grounds. For information, write Guiseppi Ratti, Via Pomea, 32, Turin, Italy.

May 2 and 9, 1961. City Garden Clubs—annual showing of gardens and pent-house terraces in New York, N. Y.

May 10, 1961. Spring Garden Tour to Bucks County, Pennsylvania, sponsored by The Volunteer Associates of The New York Botanical Garden. Note change in date from May 4 to May 10.

May 12-14, 1961. International Rhododendron Conference in Portland, Oregon, under the auspices of the American Rhododendron Society.

May 15, 1961. Annual Meeting of The New York Botanical Garden.

May 16, 1961. Torrey Botanical Club meeting at The New York Botanical Garden.

May 17, 1961. Spring Garden Party at The New York Botanical Garden.

May 25-29, 1961. Annual Meeting of the American Iris Society; headquarters, Robert Treat Hotel, Newark, N. J.

May 26, 1961, 2 P.M. American Iris Society visits The New York Botanical Garden and celebrates its founding at the Garden forty-one years ago.

June 13, 1961. Nineteenth Annual Rose Day at The New York Botanical Garden.

October 25-27, 1961. Sixteenth Annual American Horticultural Congress, Northampton, Mass.

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CREDIT FOR ILLUSTRATIONS

We are indebted to the Display Committee, Mrs. Charles Burlingham, Mrs. Richard S. Meredith, Mrs. Donald B. Straus, for the selection of the front cover illustration—a spring scene at The New York Botanical Garden, photo by Gottscho-Schleisner; pp. 37, 38, H. W. Rickett; pp. 42, 43, P. Hale; pp. 44-46, R. M. Klein; pp. 49, 50, 52, E. N. Mitchell; pp. 56-60, T. H. Everett; p. 54, map, and p. 63, **Liriodendron tulipifera**, C. C. Clare, Jr.; pp. 65, 66, D. R. Egolf; p. 67, Gottscho-Schleisner; p. 68, upper, Gottscho-Schleisner, courtesy Jackson and Perkins; p. 68, lower, Old Westbury Gardens; p. 76, J. H. Clarke.

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FLOWERS AND THEIR FRUITS

By HAROLD WILLIAM RICKETT

Dr. Rickett is Acting Assistant Director (Botany) and Bibliographer of The New York Botanical Garden.

Most persons have never seen a flower.

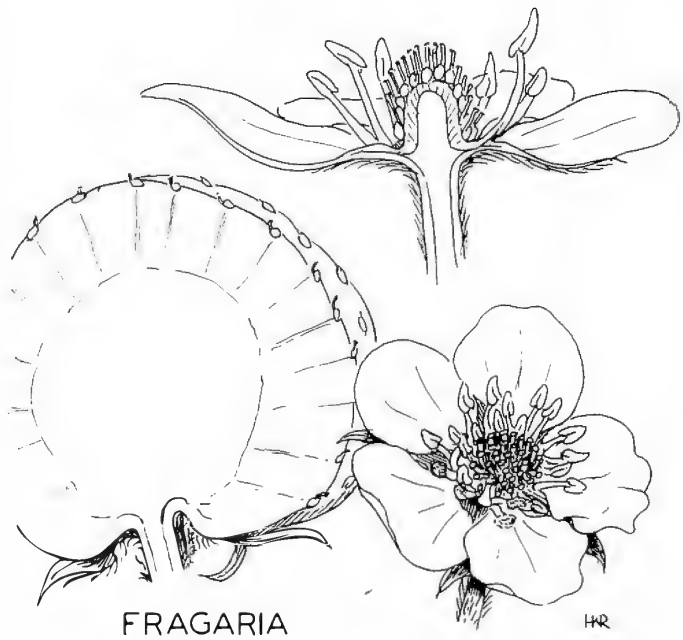
Of course that is an absurd statement. We have seen them in our parks, our gardens, our homes, perhaps in hospitals or churches.

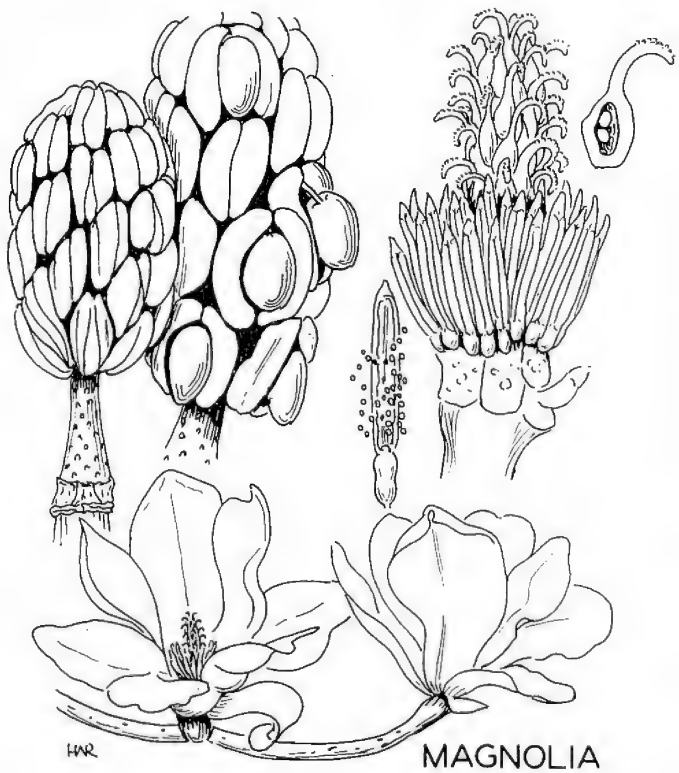
And yet there is truth in it. Most persons have never *seen* a flower. They have seen beautiful colors, graceful forms. They can distinguish a rose from a lily, a peony from a chrysanthemum. But most peonies lack the essential parts of a flower. And a chrysanthemum is not one flower but a mass of many minute flowers—and these also may lack essential parts.

What is essential in a flower? Brightly colored petals are the most obvious parts; the green sepals cover them in the bud. But many flowers lack petals and not a few lack sepals also. The flowers we grow in gardens generally have delightful odors. But there are flowers that smell like a skunk or like putrid flesh. Many flowers—including those of chrysanthemums and dahlias—are small, and their parts must be sought with a magnifier. But some are large and can be investigated with the unaided eye.

A flower of magnolia will do for a beginning. The lovely pink or white petals and sepals (they are all alike) need no introduction. In the center of the chalice rises a sort of tower or pillar, covered with small projections of two kinds. *These are the essential parts.*

At the base of the pillar are a number of short red or golden straps, curving upwards. These are stamens; they form the fertilizing dust, the pollen. Above these, pear-shaped bodies are pressed against the pillar, their narrow necks at first bent in but at full flowering curving outward. These are pistils. In the basal part of each pistil, called the ovary, is a very minute body, an ovule; or in some there may be two. "Ovule" means "little egg," and the ovary is so named for containing these "eggs." The analogy with animal reproduction is false. An ovule is not an egg; it becomes, when fertilized, a seed.

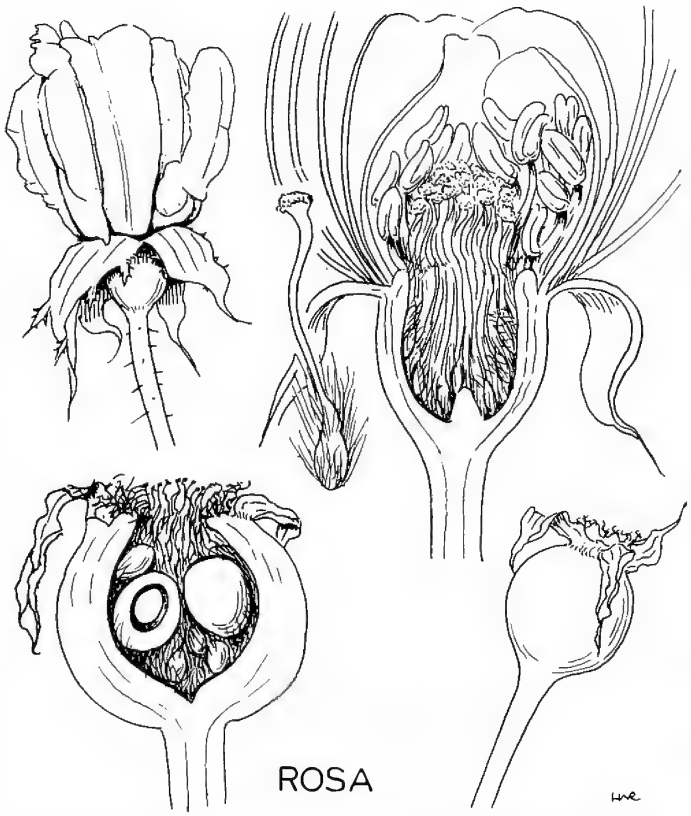




Fertilization is accomplished in three steps. First, pollen is transferred—by wind, by gravity, by insects, by other agencies—from the stamen where it is formed to a receptive, more or less sticky area, the stigma, at or near the tip of the pistil. The narrow part between ovary and stigma is the style (so named from the Greek word for "column"). Pollen consists, like the dust for which it is named, of a multitude of microscopic grains. In the second step, each grain, when deposited on a stigma, may grow, putting forth a microscopic living thread, as a seed puts forth a root. This thread penetrates the style, may eventually reach the cavity where the ovule lies, and may then enter the ovule. The third step is an actual union of living cells in the ovule, one cell from the pollen, one from the ovule; and an embryo, a new plant in miniature, is formed. The rest of the ovule forms the protective and nutritive layers around the embryo—and we have a seed.

After fertilization, the magnolia ovary around the new seed (or seeds) enlarges, becomes succulent, takes on a red color. This is what the botanist calls *fruit*. Each single ripened pistil is a fruit. But the botanist is not altogether consistent in his use of the word: he calls the entire mass of ripened pistils also a fruit, an "aggregate" fruit. When they are fully ripe, the fruits split open and the orange seeds project—attached for a time by thin threads.

Once I came on some small colored girls surveying a



large magnolia. They asked me what those red things were. I explained, as best I could. Then they wanted to know what good they were. I suggested that they might fall to the ground and grow new magnolia trees. "Mistuh," said one, round-eyed, "Do yuh mean t'say that those trees *grew*?"

The trees grew—from seeds formed in fruits through the action of pollen. That is the origin of all flowering plants. The essential players in the drama are the pistils and stamens. The beautifully various sepals and petals—collectively called the perianth, the "around-the-flower"—are merely accessory to the plot, dispensed with altogether by many species. The pistils and stamens differ in many ways in different species; but in all they are *essentially* alike and accomplish *essentially* the same result.

The botanical use of the word "fruit" may surprise the reader. Apples certainly are fruits, and peaches, and berries of various kinds. But to extend the word to refer to the inedible products of trees may seem a perversion of English. The point is that the botanist names things according to their origin, not their edibility. Fruits are the bodies that develop from flowers, no matter what their form or flavor.

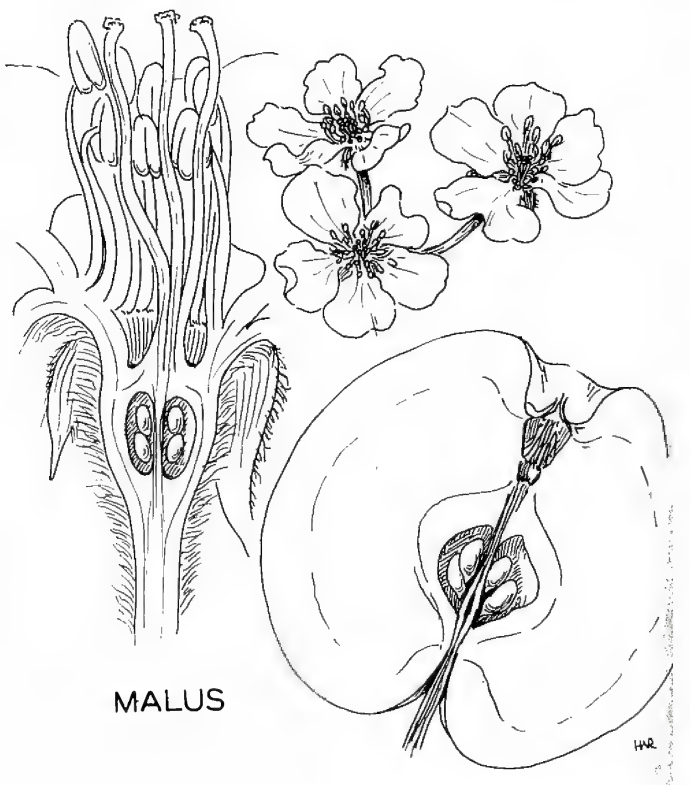
Even our edible fruits are of a surprising variety when one studies their botanical origins; berries, for instance. A strawberry is a succulent, red, delicious fruit, with a stalk and some small leaves at the broader end, and covered with seeds. What? Seeds on the *outside* of a fruit? This must be something different from the fruit described above.

It is. For a proper comparison it is necessary to look at its beginning—in the flower. Few that enjoy a strawberry shortcake have ever turned a magnifier on a flower of *Fragaria.* It has usually five white petals and the same number of sepals, with an extra rank of small leaves called bracts: all forming the perianth. In the center rises a dome or hump, comparable to the central tower of a magnolia but shorter; and covered with minute pistils. (The stamens are out on the perianth, somewhat removed from the central edifice.) Pollination, fertilization may proceed as usual; each small ovary contains a single ovule and becomes a small, one-seeded fruit—the "seed" on the surface of the berry. The edible berry itself is that central dome, tremendously enlarged and changed. Each "seed" is really a fruit, botanically; the entire mass is also a fruit, in the characteristic botanical double talk.

An amusing contrast is furnished by a rose. Any one who frequents gardens must have noticed, just beneath the brilliant petals, a swelling of the stem, a pedestal on which the flower is borne. If the flower is sliced from top to bottom, this enlargement of the stem is revealed as a hollow urn, bearing many woolly pistils on its inner surface and the other parts of the flower on its rim. Again the pistils become small one-seeded nuts (wrongly called seeds by most persons), all surrounded by the enlarged, succulent, red urn: a strawberry turned inside out.

The ways of flowers are of infinite variety. A blackberry or raspberry starts in a flower much like that of a strawberry plant. But each tiny pistil becomes a small succulent globe with a hard center (like a miniature cherry). Inside the hard central stone is a seed. Each segment of the berry is therefore a fruit; the central projection of the flower, on which the pistils stood, does not here become succulent, edible; the pistils do.

It is evident that the word "berry" has no exact significance, in botany or otherwise. A blueberry comes from a flower with only one pistil; if we search among fruits for something comparable we come to grapes and even bananas —shall we call these berries? We can only unite blueberries, strawberries, and raspberries under one term by ignoring botanical facts. If, on the other hand, we attempt to make a purely botanical definition of "berry," we reach the absurd statement suggested above—that bananas are berries but strawberries are not. Indeed the same difficulty is met



in attempting a definition of "fruit." In the above examples we have "fruits" formed of a mass of inedible pistils, of an enlarged floral stem-end, of a group of cherry-like pistils, of an urn formed from the expanded flower-stalk . . .

An apple blossom introduces us to yet another complexity —as well as to an apple. Close examination of the flower reveals the usual sepals and petals (typically five of each); a crowd of stamens; and, in the center, five slender styles with expanded tips which must certainly receive pollen—but where are the corresponding ovaries? A vertical slice through the flower reveals them—apparently in the stem just below the sepals. This corresponds to their place in a rose. But here in the apple the ovaries (generally five) meet in the center and are embedded on all other sides in the substance of the flower-stalk. The association is so close that the ovaries cannot be lifted from the surrounding material; indeed it is impossible, even with a microscope, to determine where ovary ends and flower-stalk begins. Because of this the stamens, petals, and sepals seem to grow from the top of the united ovaries themselves; and these are spoken of as "inferior" (lower). Actually anatomical study shows that the flower parts, joined with each other and with the stem that bears them, extend up around the ovaries.

And from the whole complex mass comes the apple itself. As everyone knows, the stalk of the fruit is at the opposite end from the sepals and remains of the stamens. The enlarged end of the stalk with its contained parts intervenes. A slice across an apple discloses the cavities of the five ovaries—but not just how far out they extend into the edible flesh.

Strawberries, raspberries, huckleberries, apples—these are fruits we know. Rose hips are not common on our tables, but can serve as an ingredient of jams. But we can go on with the tale: grapes, peaches, plums, cherries—all these are the transformed ovaries of flowers, with no confusing accessory parts. So are tomatoes, peppers, eggplants, string beans, which are therefore fruits, botanically speaking. And so also are the seed-pods of peas, of lilies, of milkweeds, the cotton boll, the walnut husk and shell, and many other dry, inedible conainers of seeds.

(To be continued)

A UNIQUE SOLUTION FOR CROWDED HOME GREENHOUSES

By CHARLES MARDEN FITCH

Mr. Fitch, a resident of Mamaroneck, New York, is a member of The New York Botanical Garden.

DO YOU own a greenhouse, large or small? Even if you do not have one yet, read this article to prepare yourself for the inevitable. There are few home owners who do not wish, secretly or otherwise, for their very own greenhouse.

Fair warning to all who plan to build a greenhouse—and confirmation of a problem of those who already own one —it will be overcrowded! From every beam will hang baskets, pots, cans, slabs, and logs holding bromeliads, orchids, gesneriads, begonias, and whatever other plant family you enjoy growing. All the benches will be crammed with plants that cannot be thrown out and cannot be given away because all your friends already have them. You will want to grow some new variety, but you will not be able to find adequate space for it.

Gardeners everywhere have one thing in common—an overwhelming interest in growing unusual, attractive, and often exotic plants. Once it was learned that the gesneriads, orchids, bromeliads, and other plant families could be easily cultivated with but slight basic knowledge of their habits and requirements, these tropical beauties began to be widely grown. In recent years such plant families as the gesneriads have become major topics of interest. Orchids, too, have experienced a fantastic upsurge in popularity, since commercial growers have been making an effort to publicize the easy-to-grow kinds.

Many tropical plants will grow in a living-room window satisfactorily for quite some time. However, the majority need a greenhouse atmosphere for continued healthy growth and maximum flowering. Fortunately, manufacturers of greenhouses have begun to market small, compact units within the homeowner's budget. These houses can be obtained in lean-to or free-standing styles which are attractive features when well placed on the home grounds. There are even models which fit on the outside of a large window.

A greenhouse does look bare for the first few months after it is erected. Later, it is difficult to find enough space, for the fascination and joy of growing numerous kinds of tropical or semi-tropical plants leads the hobbyist to stuff the greenhouse to overflowing in less than two growing seasons. Gardening friends and specialty plant societies constantly offer divisions of some "new" plant. Before one is quite aware of what has happened, the greenhouse has no room for another pot, tub, basket, or flat.

The worried grower cries, "There are so many more plants I want to grow, but I can't possibly throw anything out that's alive. And I can't give anything more to my friends; they have space problems too!"

Well, I had this very problem. For some time I did not know what to do with all of the extra bromeliad seedlings I had grown. Then there were orchid divisions, gesneriad rhizomes and tubers in great abundance, begonia cuttings, philodendron offshoots, pots upon pots of sprouted African violet leaves, not to mention coleus, tradescantia, and zebrina propagations.

Finally, in desperation, I began to bring boxes of treasured plants to meetings of botanical and plant societies for free distribution. This partially solved my problem of overcrowding. The members of the societies to which I belong were delighted to receive propagations of unusual things. They were not already possessors of an annex to my collection as were all of my neighbors! No one who visits my home can escape without carrying off a box of plants. Thus I solved my "extra propagations" problem.

However I still did not have quite enough room for many of the plants I wished to grow. The orchid family is so large that it alone can constitute a lifetime interest. There are also the bromeliads or "air-plants" which captured my interest when I first saw them growing on cypress trees in

Florida's vast everglades. Every day catalogs come which excite my gardener's passion for such odd tropicals as the zantedeschias (calla lilies), anthuriums, nepenthes (pitcher plants), and such bulbous items as amaryllis.

More room was needed. I just had to make space in my already crowded lean-to greenhouse.

In my home there are wide picture windows. Why was all this growing space going to waste? Here was the answer!

A trip to the local garden supply store resulted in the purchase of six plastic window boxes, each about four feet long and six inches wide.

An evening was all it took to construct inconspicuous shelf supports below the window sill. The next day I had over twenty-four more feet of sunny growing space. I filled the window boxes with exploded mica or vermiculite to provide constant humidity and moisture around the clay pots.

We decided these prominent new window boxes were to be filled only with especially beautiful plants from the greenhouse. When the gloxinias opened their buds under the greenhouse bench, they would be given a place of honor in the living-room window box. Orchids, usually rather plain plants when not in bloom, could be grown to perfection in the humid, sunny greenhouse and brought forth when in glorious bloom for proud display inside our home.

Foliage plants such as caladiums, coleus, philodendrons, and ferns are grown into healthy specimens in our ten-by-six foot lean-to greenhouse, and all winter long our home is filled with only the most perfectly groomed plants. Orchids look especially beautiful when displayed in front of complementary foliage plants. Space-consuming bulbs can be brought into flower and enjoyed indoors only while they are at their best.

Gradually the greenhouse has become devoid of all flowering plants. Every plant, when it is in full bloom, has found its way into our living-room window boxes. This is just as well, since the greenhouse can not be seen from indoors anyway.

Now our home is a greenhouse in itself, and the constantly rotating plants provide new pictures *inside* the picture windows. During the winter we gaze over orchid blooms to watch birds at the feeders which are covered with snow. In the summer cool caladiums enjoy the window boxes which are then shaded by the foliage of oaks.

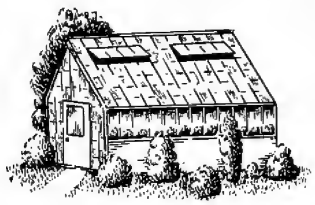
Delicate blooms last even longer on plants in our living-room than they do in our greenhouse. The greenhouse has a constant humidity of perhaps seventy-five to eighty per cent which is fine for healthy growth but tends to shorten the time the blooms are in good condition. In the drier, slightly cooler atmosphere of our living-room window boxes I have had some hybrid cypripediums or paphiopedilums (lady-slipper orchids) hold their blooms in perfect splendor for over eighty days. It is not uncommon for some of our dendrobium blooms to last two months in winter in a sunny window.

My small lean-to greenhouse is kept at a tropical temperature. (The majority of hobbyists' greenhouses are kept between semi-tropical and tropical temperatures, which permit them to grow with ease the more exotic plants.) The temperature does not go below 64° during winter nights except under the benches where, with the aid of fluorescent lights, I grow such cool-loving plants as geraniums, ferns, and the lovely *Eucharis amazonica* or Amazon-lily.

With this rotation system of greenhouse to window box, I find that it is possible for me to grow a surprising number of plants. My extra propagations still go to plant societies where I meet friendly people interested in growing unusual plants. These fellow gardeners supply me with cuttings of plants new to my collection, which I am now able to accommodate.

If you are faced with a space problem in your greenhouse (and what gardener isn't if he has a glasshouse!) try my system of turning the living-room into a plant show-case. You will be thrilled by the extra space it gives you, the added experience of constantly enjoying blooming plants at close daily range, and the compliments from friends about your greenhouse home!

A GREENHOUSE ON A SHOESTRING



By BRUCE H. KIRK

Mr. Kirk is a member of the Market Development and Customer Service Section of the Film Department, E. I. du Pont de Nemours and Company, Wilmington, Delaware. He talked on this subject at the annual meeting of the Men's Garden Clubs of America at Ashville, North Carolina, in June 1960, from which this article has been developed.

YOU MAY be surprised to learn, as I was, that far from being a modern innovation, the greenhouse dates back more than two thousand years. Historians tell us that the ancient Romans practiced the art of forcing fruits and vegetables in pits or cellars which were covered with slabs of transparent mineral, such as mica. They even had air-conditioning—heat was supplied through the natural fermentation of manure.

It must have been the Roman legions that carried the idea into northern Europe, for there are historical references to attempts to grow fruits, such as the orange and grape, in climates far north of their natural habitat. Grapes were trained to the south side of walls and buildings and protected by crude lean-tos of glazed sash. These were not adequate for winter culture, but served to make the summer and fall conditions similar to those farther south.

Orange trees, which had to be protected in winter, were completely enclosed in a framework which was covered with wooden shutters and heated by stone fireplaces. Glass was not used in these structures, but the shutters were removed in summer to allow the trees to receive sunlight directly. A house of this type, built early in the seventeenth century in Heidelberg, Germany, is described as being thirty-two feet wide by some four hundred feet long and sheltering four hundred small orange trees.

The evolution of the greenhouse came about through a combination of these two early ideas. In the early part of the eighteenth century glass roofs on complete structures were found to be practicable, and so the real forerunner of the modern greenhouse came into being. Heated glass-

houses—or stove houses, as they were called—appeared in this country in the latter part of the eighteenth century. These were of the shed-roof type, having a solid north wall and a glass roof sloping southward. Heating passed through the house from an outdoor fireplace by brick flues. Steam and hot-water heating were in use in the early 1800s.

The industrial expansion in the United States that followed the Civil War carried greenhouse construction forward. Statistics from the United States Census report only one commercial greenhouse before 1800; only three before 1820; and only one hundred and seventy-eight in 1860. By 1890 there were more than forty-six hundred establishments, covering almost forty million square feet and valued at forty million dollars. The 1940 Census showed over two hundred million square feet under glass. The 1950 Census shows one hundred and sixty-five million square feet of greenhouses for growing flowers and about sixty-one million for growing vegetables.

With this rapid growth came improvements and refinements in greenhouse design and construction, advancements in the science of horticulture, and an interest in greenhouses for pursuing horticultural hobbies.

It is not surprising that when cheaper and better ways for growing crops were sought, plastic films were considered. While there was some use of plastic-coated wire as a substitute glazing material before World War II, a real interest in plastic materials did not occur until the early 1950s, when several researchers in Europe and in the United States began to experiment with polyethylene film.

Polyethylene film gained favor because it is inexpensive and because its properties make it an extremely versatile material for many horticultural uses. These include thermal lining of glass greenhouses, glazing for greenhouses, coldframes and hotbeds, mulch, silo covers, pond and irrigation ditch liners, and tarpaulins. The film has one basic disadvantage: it deteriorates rapidly under intense sunlight. It is therefore limited as a glazing film to seasonal use; six to nine months if used during the winter, and one to three months if used during the summer. Because of this basic disadvantage, it was natural that steps would be taken to develop longer-lasting plastic films for greenhouse use.

After several years of intensive research and development, tests and evaluation, it was evident that Type W weatherable "Mylar" polyester film was a real breakthrough as a tough, durable film for outdoor glazing applications. Weatherable "Mylar" is the strongest of all plastic films, with a tensile strength roughly one-third that of machine steel. It has remarkable resistance to acids and solvents, is serviceable under extremes of temperature in any climate, is unaffected by bacteria and fungi, will not become baggy with changes in temperature and humidity, and has the toughness to withstand the punishment of most hail-storms. The durability of weatherable "Mylar" under exposure to Florida's sun has been demonstrated to be four to seven years; four years in a 45° exposure facing south and seven years in a vertical exposure.

Success of plastic films for glazing greenhouses depends largely on how well the film is fastened to the structure and the soundness of the structure itself. Most growers have shown their ingenuity in erecting a structure which is reasonably sound.

However, with four-to-seven-year weatherable film, it was necessary to find the answers to certain questions in order to ensure satisfactory performance for the life of the film. There was little knowledge of what angle of roof was best to shed snow and moisture from condensation; there was little information on the design of the frame, and on what spacing was required between rafters. No one really knew how this new plastic film would behave in a high wind.

Research was directed along several avenues and included field installations with commercial growers over the United States and with a number of universities. A program of wind-tunnel tests was carried out at the University of Maryland. The wind-tunnel tests were vital for determining how to properly apply weatherable "Mylar" so that it would withstand the forces of severe storms. These tests were conducted on typical roof panels on a greenhouse model and under conditions simulating the most severe winds encountered outdoors. Tests included wind velocities as high as one hundred and twenty miles per hour.

The development program showed that the proper way to install weatherable "Mylar" polyester film is lengthwise on the roof, with the film overlapping shingle-fashion at each successive run. The basic advantages for lengthwise installation are: a) The film can be pulled "drum" tight, thus reducing "film-flexing" with wind. b) No film edges are under battenstrips. c) No nail holes occur near film edges, thus reducing the possibility of nail-hole tears. d) It is faster and easier than most other methods of installation. e) It gives a neat appearance.

In 1956 a hobby greenhouse was built of weatherable "Mylar" polyester film, which was then still in development. This greenhouse measures 15 x 30 feet and is of 2 x 2 and 2 x 4 redwood, with rafters spaced twenty-four inches apart. The film was installed lengthwise with a six-inch overlap; ordinary plaster lath was used to hold the film to the rafters. A 45° roof slope was used—this was based on the early work on plastic greenhouses done at the University of Kentucky. An inside film layer of polyethylene was installed to save heat and reduce condensation drip.

Roof ventilators were built in the greenhouse, according to the original design; but it has since been found preferable to eliminate the roof ventilators and to air the greenhouse with a ventilator in one end and an exhaust fan in the other, controlled by a thermostat. A simple space heater (using natural gas) was provided, and fans were added within the greenhouse to distribute the heat uniformly. In winter the exhaust fan is blocked off with plastic film, and the interior fans and ventilator prove adequate for circulating fresh air. The owner, a scientist, has commented that growing conditions have been ideal.

It cost about two hundred dollars for the materials for building the shell and the film for glazing, or about forty-five cents per square foot of ground area. The lumber was redwood, which made the material cost appreciably higher than if the greenhouse had been constructed of pine or fir; either pine or fir is suitable when treated with wood preservative. Approximately eighty man-hours were required to build the shell and cover it with film.

Additional costs were about one hundred and twenty-five

(Continued on page 43)

"BETTER DAHLIAS" ARE NOT EASY TO GROW

By PAUL HALE

Mr. Hale is Editor of the *Bulletin of the Central States Dahlia Society.*

"WHAT IS the cloth for?" "I see you shade your plants from the hot sun." "You have surely gone to a lot of expense and trouble." These are typical of the questions and remarks I hear when uninitiated visitors come to my cloth house. My answer is always the same: this extra trouble and expense enables me to grow "better dahlias."

The term "cloth house" is a general one. Many types of material are used to cover frameworks over dahlia patches. "Aster cloth" is the most common, but some growers even go to the expense of covering with a fine mesh screen wire or a nylon mesh.

The meaning of the term "better dahlia" is sensed by the visitor the very minute he steps inside the cloth house. To one who has never seen dahlias growing under cloth, I explain that a cloth house produces more luxuriant foliage, longer stems, bigger blooms, more perfect and refined blooms, and more blooms per plant.

A cloth house has many advantages, which are seldom recognized because most people think only of shade. There is cloth on the sides and top of the cloth house; so moisture evaporated from the soil and transpired by the plants is conserved. Higher humidity causes a more luxuriant development of foliage, and this results in better growth and health than does sun-dried or wind-burned foliage.

Cloth breaks the force of the wind and rain. A driving rain is reduced to a gentle mist, and a hot summer wind is slowed down to a breeze that will not break plants nor burn foliage.

Certainly cloth reduces the direct rays of the sun, and this reduces foliage burn and makes the stem grow longer.

Cloth definitely keeps out leaf hoppers, grasshoppers, cucumber beetles, borers, and cutworms.

Another advantage is the longer growing season that a cloth house offers. I have weathered two frosts that wiped out other growers' dahlias, and thus gained from three to four additional weeks of growth and blooms.

The question arises, "Are there any disadvantages to a cloth house?" I reply, "Yes, but disadvantages are fewer although highly significant."

Cloth is not cheap, and it costs more each year; the same may be said for the wooden or pipe framework that must be maintained and repaired. Also, it takes time to build a cloth house and to annually install and remove the cloth. A further difficulty experienced in a cloth house is that while it wards off the larger insect pests, it offers the perfect conditions for red spider and plant lice. A grower must continue his spraying program to kill the spider mite. Slugs seek the cool humidity a cloth house offers, and they must be combated.

Another aspect that must be considered is the soil in a

This cloth house measures forty-five feet by fifty feet by nine feet high. It is neat and clean in outward appearance, and within there is a beautiful display of dahlias.

cloth house. Once the house is built, the grower is stuck with the soil inside. Rotation is no longer possible, and care must be taken to maintain the necessary nutrient elements in proper balance. Nutrients must be constantly replaced but caution must be exercised not to supply too much chemical fertilizer lest heavy applications should ruin the soil.

Perhaps the reader has now made up his mind whether or not a cloth house is worth all the trouble. For those who believe it is, the remainder of this article may be helpful.

The selection of the site is most important. The site should be far enough from trees and shrubs to avoid root competition, yet within a reasonable distance because they offer a good windbreak. Reasonably good, well-drained soil and full sun are the most important requirements.

Dahlia cloth houses vary in size, shape, and construction as do other structures, but essentially they consist of a framework covered with cloth. A wooden framework is the more economical: but if one can afford the additional expense, a pipe framework has the advantage of longer life with little or no replacement. My cloth house consists of treated posts set four feet in the ground, with two-by-four uprights mounted to the posts, and one-by-four cross strips with galvanized wire to support the top. The system of wire crisscrossing the roof and sides is a "must," because it provides a means of anchoring the cloth with small "twists" of wire. If the cloth is not anchored in this manner, it will billow with every breeze.

For covering, I use aster cloth, which is a closely woven cotton cloth considerably finer than either nylon or wire screening. Aster cloth is reinforced every nine inches both ways by half-inch-wide bands of thread pulled together. These bands offer strength and a means of anchoring the cloth to the crisscross wire support. Several firms make a cloth of this type. It is the same as that used by the growers of Burley tobacco in the southern states. It costs extra to have the strips sewn together into one big piece for the top, but it is to the grower's advantage to spend the money if only for the time saved in installation.

So much for the why, where, with what, and how to build a dahlia house. The house may be "standard" or "de luxe." Some growers have a watering system, lights, and space for a chair and table where they can relax among their beloved dahlias and sip a refreshing drink as they listen to the strains of Bach or Beethoven. I'll forego these elaborate extras until the four Hale children have been educated and are gone from home.

My cloth house is definitely a luxury, a luxury I fully enjoy, for it has elevated me to the élite circle of experts who regularly top the shows with the best dahlia flowers.

The dahlia has come a long way since it was first noticed by the Spanish naturalist Hernandez, who had been sent to Mexico by King Philip II to study the natural history of that country. To the casual observer the plant the Spaniard found in the mountains of Mexico in the sixteenth century, and which still grows there, bears little resemblance to the dahlias grown today.

In 1789 seeds of acocti—the native name by which the plant was then known—were sent to physic and botanic gardens in Europe. Some of the seeds reached Andreas Dahl, a Swedish botanist and student of Linnaeus. Dahl displayed such keen interest in the plant and its culture and development, that the species was later named *Dahlia* in his honor.

Greater perfection of bloom, straighter and larger stems, more luxurious foliage, and more blooms to a plant are the rewards of growing dahlias in a cloth house. The petals of this bloom of 'Judith' reflex toward the stem and form a good "ball."

The wild species was for a time known as *D. variabilis;* subsequently the earlier name *D. pinnata* was substituted. This is the species from which thousands of varieties have been bred.

From *D. juarezii,* discovered in Mexico in 1879, the cactus-flowered forms have been developed. The Editor.

GREENHOUSE (Continued from page 41)

dollars for the heating equipment with a thermostat and about one hundred dollars for the ventilating equipment, including the fan. Home-made benches were built of surplus materials, for which no costs are available. The cost of this greenhouse then, excluding labor which was provided by the hobbyist, came to under one dollar per square foot. Tying-in the heating of the greenhouse to the home heating system obviously would reduce the total cost.

Many amateur gardeners prefer to build their own greenhouses and design them to suit their particular needs. Basic information in construction and glazing is to be found in a folder entitled "Suggestions for Glazing with Weatherable 'Mylar' Type W."

For those gardeners who are not complete "do-it-yourself" enthusiasts, a prefabricated kit-greenhouse is available from the Turner Equipment Company, Goldsboro, North Carolina. Other interesting greenhouses using plastic film are to be had from leading greenhouse manufacturers.

PLANT PHYSIOLOGY AT THE GARDEN

A Personal Confession

By RICHARD M. KLEIN

Dr. Klein is Alfred H. Caspary Curator of Plant Physiology at The New York Botanical Garden.

I THINK THAT my fate as a plant physiologist was sealed when I first learned that plants are made up of cells. The almost infinite permutations by which these irregularly shaped units are built up into the divergent forms that we see as leaves, stems, and flowers stimulated a curiosity which has not yet abated.

Plant physiology is operationally defined as the study of the mechanisms whereby plants do things. The key words here are "mechanisms" and "do"—and the choice of special fields of research is most frequently determined by the personal preferences of the individual. In my own case, I was initially enthralled by the possibility that a study of plant chemistry could provide insight into the mechanisms that controlled the genesis of plant form. As a beginning graduate-student in botany, I seriously considered plant biochemistry as a career. In preparation for this, I was awarded an appointment in the laboratory of the late Prof. E. S. G. Barrón, an authority on metabolic biochemistry, while continuing my studies in the Department of Botany at the University of Chicago. Together with my botany professor, Dr. G. K. K. Link, I spent over two years studying the enzyme pathways by which the cells of the potato tuber produce the energy required for life. Later, and for an entirely different reason, we studied the intermediary metabolism of the tomato stem—a research problem which occupied about fifteen months.

After the excitement of writing up our results and seeing them published had subsided, I decided to straighten up my files; during this chore I went through my notebooks containing the data upon which these two papers were based. Out of curiosity (and to procrastinate, for I dislike going through files), I casually compared the tables, graphs, and histograms that expressed the results of our work on potato tuber tissue and tomato stem tissue. I was immediately struck by the similarity between the two pieces of research and letting the clean-up wait, I decided to pursue this comparison. After several hours my initial suspicion was confirmed. Step by step, enzyme by enzyme, and substrate by substrate—the results were almost exactly the same!

Now, I knew that a potato tuber is, morphologically, a stem, and I also knew that both *Solanum tuberosus* and *Lycopersicon esculentum* are in the family *Solanaceae* and are, in fact, very closely related. Yet, anyone knows that tomato stems are aerial and are photosynthetic and that potato tubers are subterranean, usually do not carry on photosynthesis and, clearly, are storage organs. Freshman texts state that the major carbohydrate in the cells of the tomato stem is sucrose, and even a botany graduate-student knows that potato tuber cells are full of starch. No one confuses the two. Yet, on the basis of our three and a half years of research, as expressed in precise tables and curves, I could not tell a potato from a tomato. At this point. I left biochemistry.

An examination of the variety of subjects that might have the intellectual excitement which a career in plant physiology can provide, indicated a number of intriguing sub-disciplines. Photosynthesis—the study of the mechanisms leading to the formation of compounds containing available energy—was, to me, too close to biochemistry. Other fields, such as the mechanisms of ion uptake, translocation of water and solutes, nitrogen metabolism, and transpiration, were not "my cup of tea." And so I seemed to be drawn to the field which, for want of a better term, is called "growth and development."

Developmental plant physiology is an ill-defined group of scientific disciplines with several tails currently big enough to wag the body. Several of these subgroups are extensively investigated by a large number of scientists. The biosynthesis, movement, interrelations, and mode of action of the auxins (including indole-3-acetic acid, 2,4-dichlorophenoxyacetic acid, etc.); the newer but allied studies of gibberellic acid and kinetin, the role of radiation in devel-

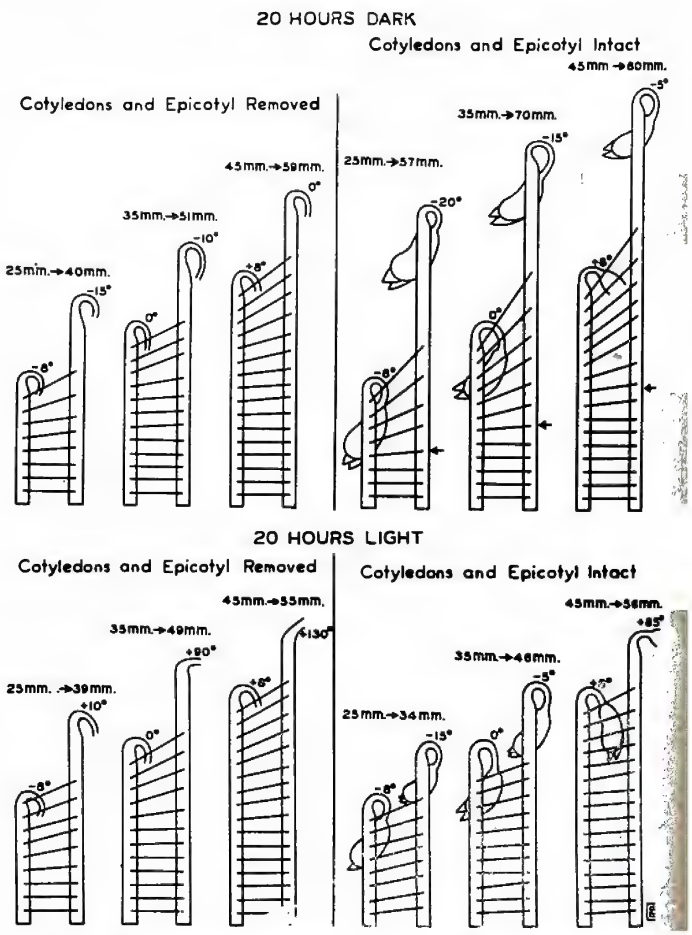


FIGURE 1. Diagram of the growth of bean seedlings showing the zones of growth under conditions of light or darkness. (Drawing by C. C. Clare, Jr.)

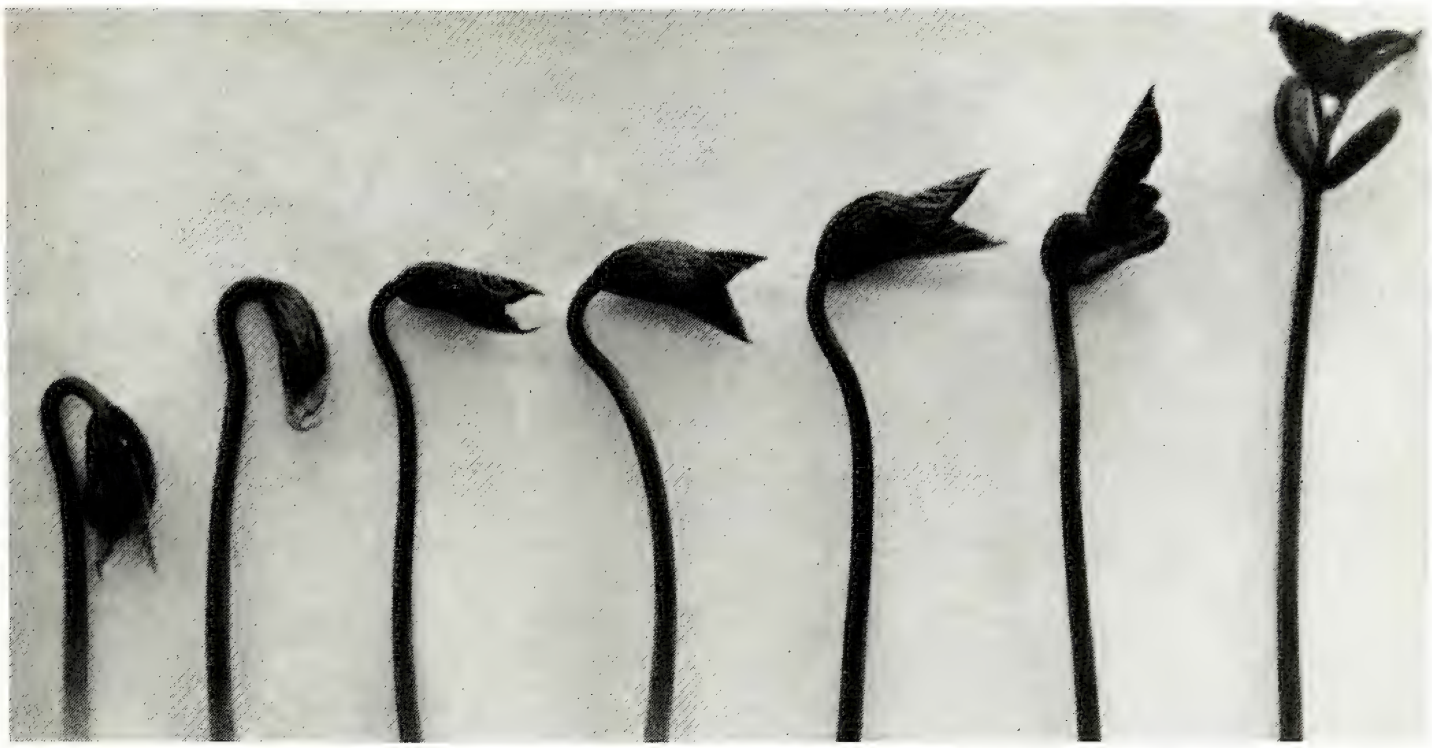


FIGURE 2. Stages in the elongation and maturation of bean seedlings. The stages illustrated require about four to five days.

opment, the interplay between genetic composition and growth, and aspects of vitamin metabolism, each occupy the attention of developmental biologists. There are, of course, the precise equivalent of these interests among zoologists and microbiologists.

Being a "horizontal" discipline—that is, a bridge between many of the somewhat isolated "vertical" or separate disciplines in botany—the field of growth and development places a premium on the capacity to relate many findings from seemingly diverse subjects directly to the developmental processes of plants. Anatomy, morphology, taxonomy, mycology, and biochemistry are all germane to development. This integration is, of course, not unique to developmental physiology. The taxonomists use information obtained by physiologists and morphologists in their studies on the interrelations among groups of plants; ecologists use the data supplied by taxonomists, physiologists, and microbiologists in clarifying the interrelations among individuals; and pathologists build on the knowledge of mycologists, physiologists, entomologists, and others in working out host-parasite complexes. Similarly, I wanted to be able to relate the accumulated information from other fields of botany and cell biology to the development of the individual plant.

Obviously, the selection of experimental material is as broad as the plant kingdom and the topics selected are as diverse as are plants. Yet, there are several points that tend to restrict one's choice. It is generally assumed that information or facts obtained through the examination of one plant may be of pertinence to others. This is the pragmatic rationale for many studies and, as we have seen, it has paid off handsomely. Our knowledge of heredity is based on peas, fruit flies, corn, mice, pink bread-mold (*Neurospora*), and the colon bacterium, *Escherischia coli* together with its virus parasites (bacteriophage). From these heterogeneous organisms, valid predictions are made throughout the world on the outcome of crosses of many organisms including man. In this way, knowledge is confirmed, codified, and used. For these reasons, the selection of a test organism and the phenomenon to be studied are canalized so that the information may be of pertinence for many organisms and for many phenomena. To investigate mechanisms of root growth, I pick a plant with a "typical" root system (unless I specifically want to study the specialized or unusual). This has led physiologists to use relatively few "guinea pigs" Peas, beans, corn, tomatoes, sunflowers, and oats are favorite plants. Very frequently, a plant may have special features which make it ideal for particular experiments. *Citrus* responds dramatically to mineral deficiencies; the pollen of *Ginkgo* produces a very rapidly growing tissue culture; the nuclear structure of *Spirogyra* is easily visualized; and the stem tips of *Dryopteris* are amenable to precise surgical studies of the apical meristem. Fungi, too, present certain special features which make them ideal for studying the interplay between genetic capacity and growth processes.

These statements can best be illustrated by a description of some of the research now in progress in our laboratory.

As is true of all children, I became fascinated by the germination of bean seeds and the early development of the resulting bean plant. The first apparent change is the uptake of water into the cells and into the intercellular spaces. Biochemically, this is a period in which enzyme activity begins with attendant increases in the rate of the breakdown of food reserves (hydrolysis) and increases in the production of energy (respiration). The root begins to elongate by cell enlargement, pierces the seed coats, and the seed is said to have germinated.

At first all cell divisions in the seedling are localized in the root tip as it pushes into the soil. Cell elongation is

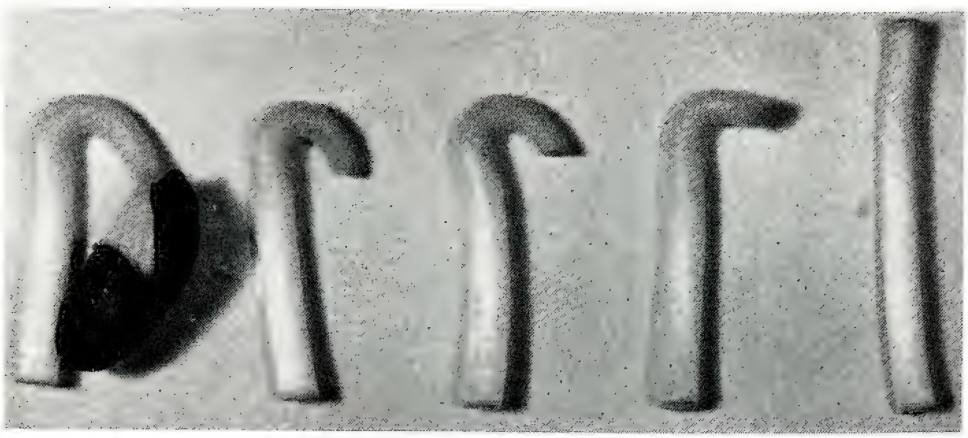


FIGURE 3. Left. The opening of the plumular hook of dark-grown bean seedlings. The stages shown in the photograph require about twenty hours after treatment with dim red light.

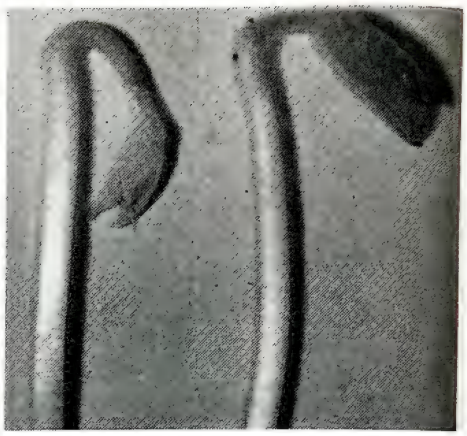


FIGURE 4. Right. The effect of one minute of dim red light on the straightening of the plumular hook and the expansion of the seed leaves of dark-grown bean seedlings. Photograph taken twelve hours after illumination of seedling on the right. The seedling on the left was taken from an unilluminated plant.

primarily responsible for the early growth of the shoot—most of this growth being localized in the lower stem (hypocotyl). While still in the seed, the hypocotyl is arched; as it emerges and elongates, the cotyledons are literally pulled out of the soil. This arched portion of the hypocotyl, the plumular hook, persists until the hypocotyl reaches almost mature length. The seed leaves then expand, the upper stem (epicotyl) begins to elongate, and the young seedling then straightens out. Seedling development is thus a linked series of events in the multicellular system we call an individual plant. Personally, I am still more than somewhat awed at the magnificent execution of these manifold maneuvers that almost invariably result in the development of a "perfectly ordinary" bean seedling.

For study, seed germination and seedling growth must be broken down into "part events." Our laboratory has chosen three of them for our investigations. These are the control of the elongation of the hypocotyl, the straightening of the plumular hook, and the expansion of the primary leaves. Fortunately, we had available a good deal of background information on these processes upon which we could build and, as you will see, this background information was derived from a number of disciplines. From anatomical studies, we knew that the elongation of the hypocotyl is due primarily, but not exclusively, to uniform elongation of cells of all the tissues; the straightening of the plumular hook is due *solely* to the differential elongation of a relatively few cells on the concave side of the arch, and the expansion of the seed leaves is, again, due primarly to cell enlargement. In elongation and arch straightening, the enlargement of the involved cells is exclusively in one direction, parallel to the long axis of the shoot; leaf expansion is two-dimensional, parallel to the surface of the leaf. Genetic studies have indicated that the extent of hypocotyl elongation and the rate of leaf expansion are ultimately controlled by specific genes. Available data suggest that the preceived development involves profound biochemical changes, and several workers have pointed out the precise correspondence of the structural details of the stem with well-known engineering principles of stress and strain.

The elongation of the hypocotyl is, of course, a time-dependent process. Furthermore, the whole hypocotyl doesn't just elongate at one time or elongate at random throughout its length. We took bean seedlings of several different lengths and marked off equal intervals on the stem with a complex piece of laboratory apparatus (a dime-store comb dipped into India ink). Growth could be followed by measuring the changes in the distance between ink dots. As seen in figure 1, the most basal segment of the smallest (25 mm.) plants examined had already ceased elongation when our study began; elongation of a longer segment of the 35 mm. seedlings was complete; and almost half of the largest seedlings had reached mature length. This suggested that elongation is, in fact, a wave process in which cells at the base of the hypocotyl complete their elongation before the cells in the middle, until ultimately the ones nearest the cotyledons elongate. This has been confirmed by the elegant technique of time-lapse photography. The presence or absence of light and the presence or absence of the cotyledons and epicotyl profoundly affect hypocotyl elongation.

Several investigators had previously demonstrated that the elongation of the most apical portion of the hypocotyl required sugar (primarily transported from the cotyledons after the hydrolysis of the starch reserves) and hormones obtained by the downward transport of auxin formed in the epicotyl. Our researches confirmed these findings and supplemented them with the discovery that gibberellic acid was also stimulatory. Clearly, if elongation starts at the base of the shoot and auxin, sugar, and gibberellic acid are formed on the apex of the plant, there must be a gradient of these growth regulators from apex down. Apparently the basal segments elongate first, because the intervening tissues transport the growth regulators downwards very rapidly. Although it is not yet proven, it seems possible that the concentration of these factors is initially too high in the apical segments to allow elongation and that this concentration-gradient decreases with age. Rates of production, blocks to downward transport, and enzymatic destruction must also be considered.

At the moment, we are trying to find out if the mature basal segments are capable of further elongation. That is, are they still responsive growth substances (which would indicate that their supply from the apex had been cut off) or are they absolutely recalcitrant to growth-promoting sub-

stances (which would indicate that the limiting factor in their growth is not the supply of growth substances)? The problem is somewhat complicated by the fact that we know that sugar, auxin, and gibberellic acid are not the only growth substances involved and that the several growth substances acting together in a single phase of any growth process have optimum concentration ratios. If, as we now believe, the "normal" mature length of a cell is not necessarily representative of the inherent capacity of that cell, these experiments will have extended our knowledge of the range of reactability of cells.

As I pointed out above, the straightening of the bean seedling is accomplished by the unidirectional elongation of a relatively few number of cells on the concave side of the arch of the plumular hook. In a seedling grown in light, this straightening occurs only after the hypocotyl reaches almost mature length and starts just about the time the seed leaves begin to enlarge (Figure 2). If the seedling is grown in complete darkness, the hypocotyl will elongate enormously (five to ten times that of light-grown seedlings), but the hook persists and the seed leaves remain embryonic. It was found by others that a very small "shot" of light would trigger both these growth processes. Once light-activated, the processes are light-independent. The effective wavelengths were centered about the red end of the visible spectrum (6600 Å). This positive effect of red light could be completely negated by far-red light (7600 Å)—an exciting finding in view of the fact that red and far-red light are the same pair of wave-lengths involved in the germination of seeds, in flowering, in the budding of mosses, and many other growth processes in both plants and animals. The elongation of the few cells on the bottom of the arch of bean plants becomes a model for investigating the role of red light in cells of all types. In our case, we wanted to use the plumular hook as a test system to see if we could find out just what the red light does within the cells.

From earlier work, at the Smithsonian Institute, we found that the opening of the hook could be measured quantitatively by excising plumular hooks of dark-grown bean plants in a standard fashion and measuring the angle of the hook, which represents the extent of cell elongation (Figure 3). With this precise method, several approaches to this multi-faceted question can be formulated. We can study the quantitative interrelations (time, intensity, quality) of light and cell elongation. We can attempt to partially or fully substitute chemicals for red light to see if any particular growth factor or factors will "replace" the necessity for the light, thus giving us an insight into the biochemical basis for light action. We can also investigate the effects of other radiations, temperatures, etc., on the opening of the hook.

Our results, admittedly far from complete, suggest that the red light activates several enzyme systems which synthesize at least four growth factors which, together, can completely replace the red light. An interesting sidelight on this conclusion was the unexpected finding that one of these growth factors is what I have called an "auxin recalcitrance" factor. That is, our evidence suggests that one limiting factor in hook opening is the presence in the zone of elongation of an excessive amount of auxin. As long as the apex of the plant continues to produce and to transport these high concentrations of auxin to the hypocotyl, hook opening is suppressed. Red light, or ultra-violet radiation, somehow reduces the biologically effective concentration of auxin to a stimulatory level. As we expected, application of a compound which specifically antagonizes auxins *in situ* will permit hook opening. Additional evidence for this phenomenon is obtained when the source of the auxin (cotyledons, young leaves, and terminal meristem) is removed (see Figure 1 for measurements of hook angles in plants with, and without their "heads"). How do the presumed "light substitutes" work? What is the action of ultra-violet light in auxin recalcitrance? Does the cobalt ion (one of the light substitutes) interrelate with auxin utilization? Why does elevated temperature (a physical light substitute) work? Can the finding on auxin recalcitrance be related *in vivo* to the observation that the hook opens when leaves and epicotyl enlarge? Preliminary observations indicate that there may be a profound reduction at this time in the capacity of the shoot cells to transport auxin.

At the moment, we haven't much information on the red-light-induced enlargement of the seed leaves (Figure 4). Work in several laboratories has shown that the red-light effect is the major physical factor and that chemical substitution for light is possible. We are studying the responses of the leaves to X-rays, because we believe that this particular test system may supply badly needed information on the responses of plant cells to ionizing and visible radiation. Here, bean leaves are nearly ideal for determining growth responses to several types of irradiation in the presence of specific chemicals.

Another problem currently under investigation will, I believe, illustrate the sequential nature of research. About a year ago, I invited a high school student, Emarita Caputo, to work in our laboratory for a Science Fair Project (see *The Garden Journal,* Vol. 10, No. 4, p. 157). Her interests led us to design experiments to determine the effect of zinc ions on the growth of tissue cultures—a problem which had previously received some attention only in France. Upon the completion of her problem, with library research and discussions with Dr. Jacques Lipetz (who was then working in the Garden's Research Laboratory), it seemed probable that the results Miss Caputo obtained were directly applicable to another botanical question.

Back in the 1940s, Professor Folke Skoog at the University of Wisconsin postulated that adequate concentrations of zinc ion were necessary for normal plant development because zinc was required to maintain optimal concentrations of auxin. It was not clear at that time whether the zinc was needed for auxin synthesis, to control auxin destruction, or to facilitate auxin transport. During 1960, however, a report was published in the *Journal of Bacteriology* showing that zinc ion was a "cofactor" for the enzyme that causes the condensation of the amino acid serine with indole to form the amino acid tryptophan. Now, most of the available evidence suggested that the primary precursor of auxin is tryptophan, and it seemed logical that the plant required zinc to obtain the tryptophan needed for auxin synthesis. If all this was true, slow-growing zinc-deficient cells could be stimulated into normal growth by supplying zinc, tryptophan, or auxin. Using tissue cultures, we found that this was indeed the case. Yet, tissue cultures are a rather unique test system, and it seemed desirable to confirm these results

using intact plants. Together with Dr. Lipetz (who is now at the Rockefeller Institute) we surveyed the literature to find a plant which could be grown with relative ease, was very sensitive to zinc deficencies, and showed obvious developmental patterns which were characteristic of zinc deficiency. Orange trees were our choice, particularly when we found out that zinc deficiencies were perceived as reductions in the size of leaves (leaf expansion is known to involve auxin) and reduction in the extension of internodes (which also implicated auxin). Genetically uniform seeds were provided by Dr. W. P. Bitters of the Citrus Experiment Station in Riverside, California. Pounds and pounds of sand were washed in tap water, boiling acid, and distilled water to remove all zinc, and the seeds were planted.

At this writing, the seedlings are up and zinc-containing and zinc-free nutrient solutions are being supplied to the plants at regular intervals. When clear zinc-deficiency symptoms are evident, appropriate numbers of plants will be treated with zinc, tryptophan or auxin. Frankly, I am most interested to see if the results check with our findings with tissue cultures. If they do, a causal relation between a mineral and a plant hormone will have been established for an isolated cell system (tissue cultures) and for intact plants. If agreement is not obtained, then our theory is wrong or incomplete. "The proof of the pudding is in the eating."

Sir Cecil Hinschelwood, Nobel Laureate and President of the Royal Society of London, said, "Mystery and fascination have no end, the pursuit of knowledge has no limit." The research projects that I have mentioned exhaust neither the range nor the scope of developmental plant physiology. When, and if, we obtain the answers to the questions we are now asking, these answers will form the basis for other questions. In addition, there are equally intriguing questions which are yet to be answered. Some of these are being investigated in our laboratory. Why do some seeds require light for germination, while others are inhibited by light? What is the relation between cell enlargement and cell division in the growth of roots? Why doess green light suppress cell division?

I think it is fair to ask where all this is leading and what is its purpose. Obviously, I want to satisfy my own curiosity about the mechanisms that underlie the phenomena that I am studying. I must share these findings and concepts with other people, professional colleagues and interested laymen, so that they, too, will know more about the world in which we all live. In turn, I shall be the recipient of the knowledge that they have gathered and, together we shall have "staved off the inroads of intellectual chaos." Although information which any of us may obtain may eventually be useful for man's physical well-being, this potential practical value cannot be even the indirect motivation for true scientific work. Science, by definition, is the accumulation of verifiable information about the universe. It is, in a most real sense, a search for knowledge solely for the sake of knowledge. The historian, the student of eighteenth-century French literature, and the philologist are climbing the same intellectual mountains as are the scientists and for exactly the same reason: "Because they are there." As long as man remains curious about the world in which he lives and feels uncomfortable about gaps in his knowledge, there will be people who will continue the search.

CHEMISTRY IN A BOTANICAL GARDEN

By MARJORIE ANCHEL

Dr. Anchel is Research Associate at The New York Botanical Garden.

FOR A biochemist, a research institute connected with a botanical garden offers opportunities of an unusual kind. These have to do both with the material available for investigation and with one's associates. There is essentially no limit to the biochemical and chemical problems that a collection of microorganisms and higher plants represents. And everyday contact with specialists in the biological aspects of the problems offers a source of first-hand advice on the "care and feeding" of these organisms, as well as of other information about them which is essential for biochemical work. It also makes possible the kind of close cooperation necessary for a particular type of investigation—one that bridges otherwise widely separated scientific disciplines. Research in this Laboratory offers several examples.

The biochemical problems first investigated had to do with the isolation in pure form of antibiotic principles from the Basidiomycete group of fungi, and with chemical studies of these compounds. The New York Botanical Garden maintains a very large collection of Basidiomycetes. A survey of these had been carried out by Dr. William J. Robbins, Dr. Annette Hervey, and Dr. Frederick W. Kavanagh, and a considerable number of them were found to have antibiotic activity. The problems of producing, detecting, isolating, and characterizing the antibiotic principles involved close co-operation between microbiologist and chemist. This is generally true. The microbiologist often cannot determine whether he is dealing with a single active compound and rarely can isolate and purify it. The chemist is dependent on the microbiologist for detection of new sources of antibiotic principles, for methods of producing these in quantity, and, at least initially, for microbiological assays as a means of following the separation of the compounds in question.

The earlier work with antibiotically active fungi resulted in the isolation of a group of new antibiotics, including ochracic acid, nemotin, nemotinic acid, illudin M and illudin S, marasmic acid, p-methoxytoluquinone, pleuromutilin, fomecins A and B, drosophilins A, C, and D, diatretynes 1 and 2, and biformin. All these have been at least partly characterized chemically, and the complete chemical structure of some has been elucidated. Pure samples of these compounds were sent to other laboratories for various types of biological testing. While at least one of them has some interest as a possible anti-tumor agent and is still under study, none proved entirely appropriate for practical application.

However, interest in these compounds is by no means limited to the possibility of their therapeutic usefulness. It is apparent that they can furnish material for studies of the relationship of chemical structure to biological activity, a problem of both practical and theoretical significance. When the active material has been isolated in pure form and its structure determined, the biological effect of chemical modifications can be studied, and related compounds with more desirable properties sometimes can be synthesized.

Because of their diversity, antibiotic fungal metabolites

are of importance also for reasons less related to their practical application. First of all, they present unusual problems in biosynthesis (that is, the question of how the organism makes the compound.) For example, drosophilin A, the structure of which has been completely elucidated, is one of the most highly chlorinated natural organic compounds known. The biosynthesis of this compound is an interesting problem in chlorine metabolism. Illudin M, illudin S, and marasmic acid are compounds belonging to the group of sesquiterpenes. Terpenoid compounds include a large group of natural products and are represented in vitamins, hormones, and essential oils. Production of this type of compound by a Basidiomycete offers the desirable opportunity for a study of its biosynthesis, in which a microorganism is used as the experimental animal.

A further reason for the importance of antibiotic fungal metabolites is that many of them have unusual, if not unique chemical structures. Such compounds are of particular interest to the organic chemist because of their chemical behavior, and to the biochemist from the point of view of their metabolism. An example of this is fomecin, the chemistry of which is so far only partly known. Its behavior is, in many respects, unorthodox, and final elucidation of its structure will undoubtedly contribute information of future use to organic chemistry.

Perhaps the most unexpected group of compounds isolated as a result of this work are the polyacetylenes. These compounds were not previously known to occur in Basidiomycetes. The rare examples of them that were previously isolated came from higher plants. Acetylenic compounds were considered as mere curiosities from a biological standpoint, and at least on one occasion an incorrect alternate structure was assigned to one of them because of reluctance to accept the existence of the acetylenic bond in nature. It is now known that polyacetylenes are common in two large biological groups, namely, fungi and higher plants. Nevertheless, as natural products polyacetylenes are oddities, both because of their highly unstable nature and because of the almost complete absence of information on their biosynthesis. These considerations, combined with the frequency of their occurrence, have stimulated investigation of their metabolism in this and in other laboratories.

It was in connection with the occurrence of these compounds that another study was begun which involved microbiological, mycological, taxonomic, and chemical collaboration. Maintenance of the Garden's Basidiomycete collection, referred to earlier, involved periodic "transfer" to fresh agar slants. When the most recent transfer was begun about a year ago by Dr. Hervey, with the assistance of Mrs. Miyako Li, it seemed like a good opportunity to investigate more extensively the distribution of polyacetylenic metabolites in these organisms. Polyacetylenes show a very characteristic absorption of ultraviolet light and can be spotted readily by using a spectrophotometer. "Transfer" of the culture collection offered an opportune occasion for obtaining a sample of each culture for this purpose.

Because we wished to investigate the metabolism of the diatretynes, it was of special interest to determine which

Dr. Marjorie Anchel operates the infra-red spectrophotometer, while Dr. Trevor McMorris examines a spectrum from the ultra-violet recording spectrophotometer in the Research Laboratory of The New York Botanical Garden.

organisms produced these particular polyacetylenes. Dr. William Silverman, who was then in our group, observed that the known diatretyne producers were related taxonomically. This suggested the possibility that occurrence of these compounds, as well as polyacetylenes generally, might be relevant to a kind of biochemical taxonomy. That is, if it were found that distribution of polyacetylenes followed, in general, a taxonomic classification based on morphological characteristics, then in some instances the presence of polyacetylenes might support one classification rather than another, or might help to assign the position of an organism whose classification was in doubt. This type of study is being done in collaboration with Dr. Clark Rogerson and appears to show some promise.

Some of the problems mentioned are being studied more intensively. Dr. Nalini Valanju, a post-doctoral biochemist, is collaborating in a study of metabolic relationships of the diatretynes, using radioactive tracers. Dr. Trevor McMorris, a post-doctoral organic chemist, is collaborating on determination of the chemical structure of some of the partly characterized metabolites that have been isolated. Assisting in the work of this group are Miss Hulda Shaw and Bernard Russ.

Microbiological Research at the Garden

By ANNETTE HERVEY

Dr. Hervey is Research Associate at The New York Botanical Garden.

THE DEVELOPMENT of a collection of stock cultures of fungi and other organisms, mostly Basidiomycetes, was initiated as a result of a survey of the latter for antibacterial (antibiotic) activity. The Basidiomycetes include mushrooms, shelf fungi, and other well-known fungi. We also have fungi belonging to the Phycomycetes, Ascomycetes, Fungi Imperfecti, and Actinomycetes. Our collection of Basidiomycetes, obtained from many sources in this country and from abroad, is considered outstanding.

Studies on these organisms resulted in a number of publications from our laboratories, beginning in 1945 (by W. J. Robbins, Frederick Kavanagh, Annette Hervey, Mary Stebbins, Majorie Anchel, and others). In addition to providing reference material for our own staff members (mycologists, physiologists, plant pathologists, and chemists), our cultures have aroused the interests of microbiologists and biochemists in other institutions and in many fields. For example, Dr. F. F. Nord of Fordham University has been using Basidiomycetes in his studies on the metabolism of compounds which might be lignin precursors. Dr. H. H. Zinsser, Department of Urology, Columbia University Medical Center, recently asked for *Collybia velutipes,* a fungus

Dr. Annette Hervey, left foreground, and Mrs. Miyako Li, right background, are engaged in a periodic "transfer" of the Garden's Basidiomycete collection into fresh agar slants.

that is used as an analytical tool in the development of a clinical test for the oxalate content of urine. A personal telephone communication indicates that our having the desired culture was responsible for a gain of several months in the development of this test. It may be noted that The New York Botanical Garden is the only convenient major source of cultures for the large numbers of schools and colleges in this area.

The maintenance of a collection of stock cultures of some three thousand microorganisms presents many difficulties. The organisms must be kept alive and free from contamination. In the past, it was necessary to transfer our stock cultures at monthly intervals to prevent their drying out, a very time-consuming process. In 1947, we started to place our stock cultures under oil. Briefly, the method was to coat cultures grown on agar slants in test tubes with sterile Parke Davis mineral oil. The cultures were then stored at 15° C. Bits of mycelium can easily be fished out from below the oil to start new cultures as needed. The oil method is the only one suitable for the long-time preservation of cultures that do not easily form spores. This technique has proved to be especially suitable for the preservation of Basidiomycetes, which make up the major portion of our collection. We now have some eight thousand tubes, prepared at different times from 1947 on, containing living organisms under oil; some are duplicates, some triplicates.

We are interested in testing the viability of our stock cultures placed under oil in 1947. It would be of great interest to know how well these cultures have survived under oil for some fourteen years. A recent test in our laboratory of cultures eight and nine years under oil indicated that ninety-seven per cent of the first one thousand were viable on the first transfer to two per cent malt agar slants. As far as we know, we are the only laboratory conducting viability studies of this type.

We are also interested in the nutritional problems of microorganisms that are difficult to cultivate. Many organisms grow and reproduce well when furnished with food of known chemical composition. Some organisms grow only in nature and have not been successfully cultivated in the laboratory. Intensive studies are being made on a group of Basidiomycetes that will grow in a medium of known chemical composition only if it is supplemented with some natural material such as wood extract, malt, tomato juice, or yeast extract. What is it in these natural materials that permits the organisms to grow?

The organism to be tested is grown in duplicate or triplicate in 25 ml. of liquid medium in 125 ml. Erlenmeyer flasks at 20-25° C for a period of two weeks. The basal medium contains mineral salts, dextrose, casein hydrolysate, mixtures of purines, pyrimidines, vitamins, and minor elements. This medium is used alone or supplemented with various amounts of natural substances. Flasks are inoculated with pieces of mycelium about 1 mm. in diameter taken from the edges of cultures grown on agar. Dry weights are determined by treating the mycelium with ethanol, filtering into Gooch crucibles, and drying at 100° C.

The effect of the natural supplements varies with the fungus and the supplement. It is believed that wood, tomato, and malt extract contain unidentified growth substances which satisfy partial deficiencies from which some of these fungi suffer. The ultimate answer would be found in the isolation of such growth factors, if they exist.

In an attempt to isolate and identify these growth factors, we are fortunate in collaborating with a group of biochemists at Merck and Company. We have recently tested some two hundred and fifty of their preparations at various concentrations on *Polyporus schweinitzii.* This is but one example of the usefulness of an organism of this type as a valuable tool in the discovery of new growth substances.

Although the influence of light on the development of the fungi is well-known, the nature of its effect is not understood. We have found one of our Basidiomycetes, *Poria ambigua,* an especially favorable subject for investigation, as both growth of this organism and the formation of basidiospores by it are profoundly affected by light.

STUDIES ON SELECTIVE PATHOGENICITY

By DAVID DAVIS

Dr. Davis is a Visiting Research Associate at The New York Botanical Garden.

ALTHOUGH OUR knowledge of the nature and control of disease in plants and animals has vastly increased since the germ theory was set forth some one hundred years ago, we still have not answered a fundamental question about the interaction of the host and parasite. The question can be stated as follows: Why is the capacity of a bacterium, fungus, virus, or other microorganism to cause disease restricted to a select group of hosts and often to only one species?

At the Research Laboratory of The New York Botanical Garden, we are investigating this phenomenon, which is known as selective pathogenicity, through the use of a plant disease caused by a fungus. The disease, commonly known as Fusarium wilt, is characterized by blighting of the foliage. The microorganism that causes the disease is *Fusarium oxysporum,* a fungus that attacks a variety of plants ranging from clover to banana. However, and most significantly, if the *Fusarium* that is isolated from a diseased banana plant is placed in contact with clover, or any other plant, it will fail to cause disease. Conversely, the *Fusarium* that causes wilt in clover cannot affect banana. The two parasites are indistinguishable from each other morphologically—that is, in form or structure—as well as in their nutritional requirements; and to date the only reliable method of distinguishing the different parasitic forms of *Fusarium oxysporum* is through their selective pathogenicity. Over thirty pathogenic forms of this fungus are known, and each one is capable of attacking a specific host or group of closely related hosts.

There are two alternative explanations for this phenomenon: either the host stimulates the particular parasite or the parasite reduces the resistance of the particular host. In other words, both the host and the parasite must be examined to obtain the answer to this problem. Dr. E. W. Buxton at the Rothamsted Experimental Station in England studied the role of the host. He demonstrated that the roots of a variety of pea susceptible to the form of *Fusarium* that

Dr. David Davis inspects a test tube of a host seedling, growing in an agar-agar solution, which he will inoculate with the microorganism *Fusarium oxysporum*.

attacks pea plants produces an exudate that stimulates the growth of the fungus, while a resistant pea variety exudes substances that inhibit the growth of *Fusarium*. Examining the part played by the parasite, researchers at the University of Wisconsin demonstrated that extracts of the appropriate strains of *Fusarium oxysporum*, grown in artificial culture, induce symptoms of disease in specific hosts. The extract from the cotton *Fusarium* produced symptoms in the cotton plant not unlike those that are produced by the parasite under natural conditions of infection. The same extract had no effect on other plants. Equivalent results were obtained with the fusaria that attack cabbage and radish. These observations led the investigators at the University of Wisconsin to suggest that the selectively toxic extracts also aid in establishing the specific pathogen in the tissue of its host. Since these observations have neither been verified, nor their ramifications fully studied, we intend pursuing them further.

Other host products that may play a significant role in selective pathogenicity are the plant hormones. Plant hormones, like animal hormones, are internal secretions that are concerned with many of the critical processes of growth and reproduction. Researchers at the Connecticut Agricultural Experiment Station demonstrated that plant-growth hormones (auxins) increased resistance to *Fusarium* wilt in tomato. In contrast, certain anti-auxins increased susceptibility to disease in tomato. The auxins must have been acting through some indirect mechanism. First, they were not toxic to the fungus by themselves when they were introduced into artificial culture media. Second, susceptibility was decreased as the interval between the treatment of tomato with auxins and the inoculation of tomato with *Fusarium* was increased. The data suggest that plant-growth hormones increase resistance to disease by altering the metabolism of the host in a direction which is unfavorable for the development of disease. The mechanism by which the auxins retarded disease remained obscure for a number of years.

We now have a rational explanation of how auxins affect susceptibility to disease; they apparently retard disease by mediating the metabolism of pectins in the host. Pectins are the glue-like substances that bind the individual cells together, thereby giving the plant rigidity. Auxins determine the extent to which calcium-pectin bonds are formed. When the auxin content is very high, the pectin is in the form of a calcium salt. Calcium pectates more readily resist digestion by the pectolytic enzymes that are produced by *Fusarium* than do the non-calcified pectins. Since the advance of *Fusarium* in the host depends on the degradation of pectin, auxins retard disease by increasing the relative number of non-digestible calcium-pectate molecules.

Initial studies at The New York Botanical Garden on selective pathogenicity in *Fusarium oxysporum* are being carried out to develop methods and models that will facilitate future physiological and biochemical investigations. For this purpose, we are developing a technique of culture which involves growing plants in test tubes one inch in diameter and six inches in length. Besides saving space, this technique has other advantages: a) The time and labor spent in handling the plants are reduced. b) Growing conditions are kept uniform, since the test tubes are placed in artificial light with rigidly controlled temperatures. c) The host seedlings are grown on a substrate of agar-agar containing mineral nutrients, and this eliminates the many unknowns present when soil is used. d) The plants can readily be grown under sterile conditions. This has a great advantage over experiments performed with plants grown in unsterilized soil, since we can examine the effects of *Fusarium* or its products on the host without interference from other microorganisms or their products. e) Fortuitously, we found that certain species of plants, namely cabbage, carnation, and radish, when grown in test tubes, show disease symptoms within eight to fourteen days after inoculation with the parasite. This is in sharp contrast to the time required for the appearance of symptoms in nature. Under normal greenhouse and field conditions, there is a three-to-six week period of incubation, depending on the host and parasite in question, before symptoms appear.

The test-tube culture technique has yet another advantage. We anticipate fractionating *Fusarium* extracts to ascertain their role in selective pathogenicity, the smaller the test plant and the area to accommodate it, the less the volume of material needed to determine physiological responses. This can be a very important factor in facilitating chemical isolation since in many instances the chemist can supply only very small samples for biological testing. As a corollary to our work with plants grown in test tubes, we intend to reinforce our results by similar experiments on plants grown and inoculated in the greenhouse.

An understanding of the mechanism of selective pathenogicity in a plant disease may improve our knowledge of the relation between the host and the parasite in diseases of animal and man. When these relationships are better understood, we can more readily devise methods of preventing and curing disease.

GUIDE TO TREES

at The New York Botanical Garden

AREA I

By T. H. EVERETT

Assistant Director (Horticulture)

In The New York Botanical Garden are many thousands of individual trees, many hundreds of different kinds. This is a guide to 55 kinds (112 individuals) growing within a very few minutes walk from the main gate. To locate these trees, turn right immediately after you enter the main gate. The trees are on both sides of this road.

Maximum heights given in this guide are those occasionally attained under ideal conditions, and most usually refer to specimens growing in their native habitats. Cultivated specimens in regions other than their native habitat are usually considerably lower even at maturity. This is especially true of natives of western North America, Europe, and Asia. Most conifers (cone-bearing evergreens, such as firs, spruces, and Douglas-fir) do not really thrive under city conditions. For their best development, they need a less polluted atmosphere. Because of this many specimens of these in The New York Botanical Garden are less vigorous and less shapely than others in suburban and country areas.

1. Fraxinus pennsylvanica lanceolata —GREEN ASH (family *Oleaceae*). Native of eastern North America. Maximum height 60 ft. Has a rather narrow round-topped head and pinnate, opposite leaves which turn golden in fall. Its inconspicuous flowers appear in late spring. It differs from the red ash *(Fraxinus pennsylvanica)* in that its young branches, petioles, and flower panicles are smooth rather than conspicuously pubescent, but intermediates between these two kinds occur. This is a good shade tree, especially valued in the Plains states. It has been much used for shelterbelts. It develops best in rich, fairly moist soil but will tolerate dry as well as wet locations. The green ash is the state tree of North Dakota. Its wood is used for tool handles, furniture, cooperage, baskets, crates, sporting goods, railroad ties, veneer, and fuel.

2. Prunus serrulata 'Hata-zakura'—JAPANESE FLOWERING CHERRY (family *Rosaceae*). Horticultural variety of a species native to Japan, China, and Korea. Maximum height 20 ft. This is one of the numerous and closely similar single white-flowered varieties of Japanese flowering cherry. It forms a spreading head and blooms in early spring. Landscape use and cultural needs as for number 10A.

3. Corylus colurna—TURKISH HAZELNUT (family *Betulaceae*). Native of southeastern Europe and western Asia. Maximum height 80 ft. A stately tree, of regular pyramidal outline, well worth planting as an ornamental. Its fruits (nuts) are edible. Male and female flowers are borne separately on the same tree, the former in slender catkins conspicuous throughout winter and spring, the latter enclosed in small scaly buds from which, in spring, the red styles protrude. The nuts, in clusters of three or more, are remarkable for the appearance of the 1½ in.-wide husks which surround them. These are fringed with many long narrow pointed lobes. *Corylus colurna* and the nearly related *Corylus chinensis* are the largest trees in the genus. •

3A. Malus—FLOWERING CRAB-APPLE (family *Rosaceae*). This (at the time of writing) is unidentified as to species or variety. Flowering crab-apples are excellent small, spring-flowering trees in any good soil in full sun.

4. Prunus serrulata 'Meigetsu'—JAPANESE FLOWERING CHERRY (family *Rosaceae*). Horticultural variety of a species native of Japan, China, and Korea. The statements made regarding number 2 apply to this tree also.

5. Platanus occidentalis — BUTTONWOOD, SYCAMORE, AMERICAN PLANE (family *Platanaceae*). Native of eastern North America. Maximum height 160 ft. Parent of the London plane (number 12). The most massive American tree, it develops a tall straight trunk and a broad or round-topped-oblong head. Its bark flakes in patches showing white or cream-colored areas beneath; the upper parts of the trunk and the major limbs are often entirely white and smooth. The seed balls are usually solitary, rarely in pairs. A good shade tree, but more difficult to transplant and more susceptible to disease than the London plane. It does best in rich, moist, slightly acid soil. Its wood is used for furniture, boxes, crates, railroad ties, cooperage, fence posts, and fuel. Not to be confused with the sycamore-maple (number 6). This particular specimen is, at the time of writing, in poor condition presumably as a result of unavoidable damage done to its roots during the construction of the nearby Research Laboratory building. If it becomes necessary to remove it, it will be replaced by another of the same species.

6. Acer pseudo-platanus—SYCAMORE MAPLE (family *Aceraceae*). Native of Europe and western Asia. Maximum height 100 ft. Called sycamore in England and plane in Scotland, but very different from the true planes *(Platanus)* of which the American sycamore *(Platanus occidentalis)* is one. Compare with trees numbers 5 and 12 in this guide. Note opposite leaves of maple, alternate leaves of plane, twin winged seeds of maple, hanging seed balls of plane, evident axillary buds of maple, axillary buds enclosed by petiole in plane. The sycamore maple grows vigorously, forms a large spreading head, and is well adapted for exposed locations and seaside planting. It thrives best in a medium moist fertile soil, grows in any ordinary soil. Its foliage does not color well in fall. Its wood is white and is used for turnery and pattern molds. •

7. Abies homolepis. See number 64.

8. Picea abies—NORWAY SPRUCE (family *Pinaceae*). Native of Europe. Maximum height 150 ft. A pyramidal evergreen with wide-spreading branches, usually drooping branchlets, and rich green foliage. Commonly planted as an ornamental, it grows rapidly but in our climate does not ordinarily live more than 40 years and often becomes straggly and unattractive earlier. Given ample space, full sun, and an unpolluted atmosphere, it develops into an imposing symmetrical tree, truly beautiful during its first 25-30 years. Numerous fine specimens may be seen in nearby counties. It thrives in a wide variety of soils and is a good windbreak and shelterbelt tree. Many dwarf and otherwise horticulturally interesting varieties of this species are cultivated; many good specimens of these are in the Montgomery Conifer Collection at The New York Botanical Garden. It is an important European source of lumber and paper pulp.

9. Quercus borealis maxima—RED OAK (family *Fagaceae*). Native of eastern North America. Maximum height 150 ft. Is taller and has larger acorns with shallower cups than the northern red oak (number 46) of which it is a variety. It forms a majestic specimen with stout, spreading branches and a broad, rounded head. In fall its foliage turns dark red. This oak grows rapidly and thrives best in moist fertile soil. Its wood, similar to that of the northern red oak (number 46), is used for the same purposes.

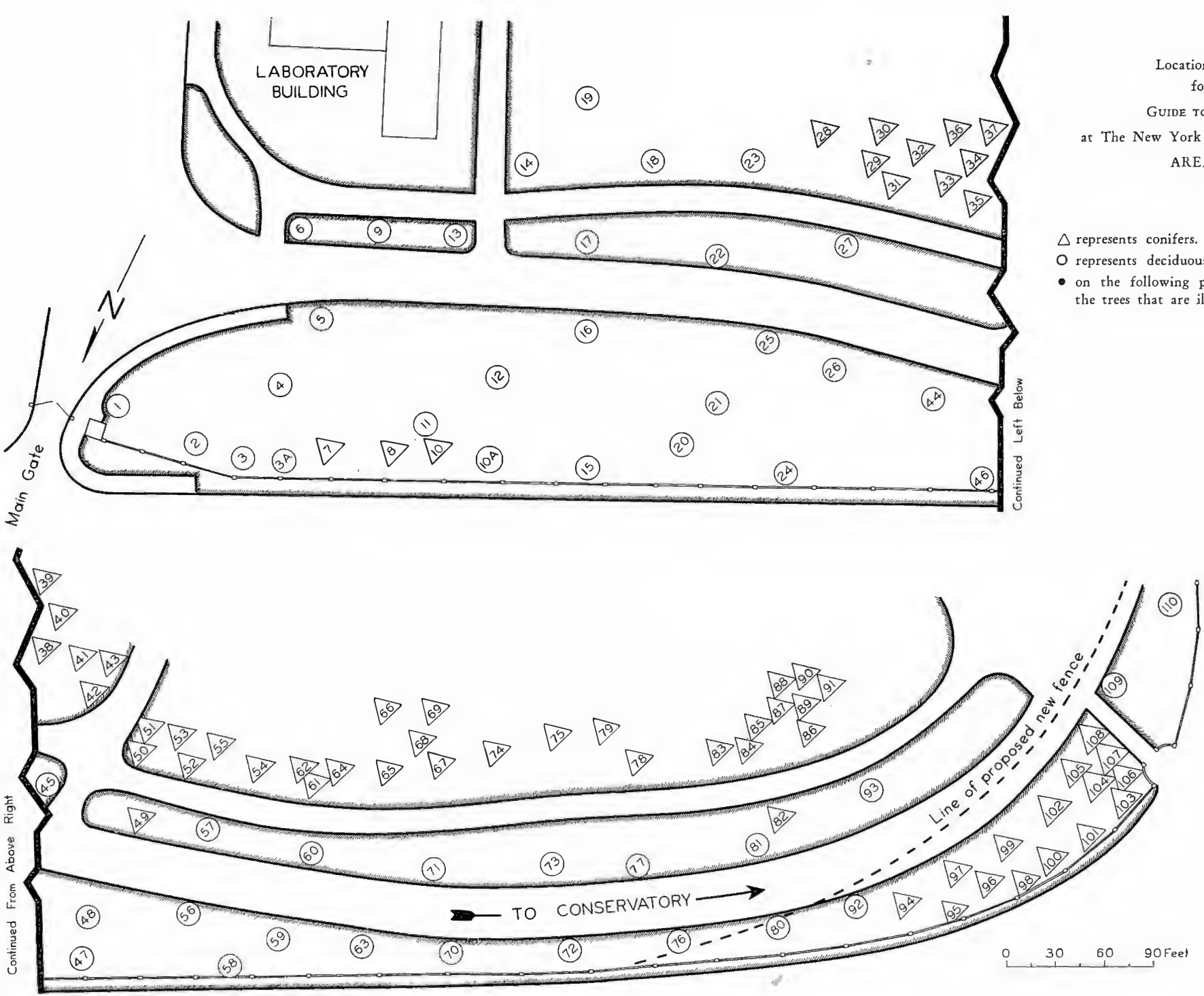
10. Pseudotsuga taxifolia. See number 82.

10A. Prunus serrulata 'Taki-nioi'—JAPANESE FLOWERING CHERRY (family *Rosaceae*). Horticultural varity of a species native of Japan China, and Korea. Maximum height 12 ft. or slightly more. This, one of the smaller-growing Japanese cherries, forms a spreading head which in early spring is covered with single white fragrant flowers. Its Japanese varietal name means "fragrant cascade." An admirable ornamental for a lawn specimen and for other landscape purposes, it succeeds in well-drained, fairly rich soil in full sun.

11. Prunus serrulata 'Fugenzo'—JAPANESE

Location Map
for
GUIDE TO TREES
at The New York Botanical Garden
AREA I

△ represents conifers.
O represents deciduous trees.
● on the following pages indicates the trees that are illustrated.



FLOWERING CHERRY (family *Rosaceae*). Horticultural variety of a species native of Japan, China, and Korea. Maximum height 20 ft. This variety, which has been cultivated in Japan for more than 500 years, forms a spreading head and has copper-colored young foliage. Its double pink flowers are borne in abundance in spring. Its Japanese name means "Goddess on a White Elephant." Landscape and cultural needs as for number 10A.

12. Platanus acerifolia — LONDON PLANE (family *Platanaceae*). A hybrid between *Platanus orientalis* and *Platanus occidentalis*. Maximum height 120 ft. This magnificent tree is a favorite for street planting in New York and in many other of the world's cities. It is easier to transplant, more tolerant of difficult environments, and much more disease-resistant than our native *Platanus occidentalis* (number 5). It withstands repeated hard pruning well and by this means can be kept to almost any desired size. The London plane forms a tall, erect trunk and a wide-spreading, rounded head. Its seed balls are usually in pairs, occasionally singly or in threes. Its bark peels in large flakes exposing yellowish areas beneath. When raised from seeds young trees vary in their foliage characteristics, some favoring one parent, some the other. Most, if not all, of the specimens growing in the New York area called oriental plane *(Platanus orientalis)* are really London plane *(Platanus acerifolia)*. The London plane thrives best in rich, moist earth but will grow in a wide variety of soils. Its wood has the same uses as that of buttonwood (number 5). ●

13. Liriodendron tulipifera — TULIP-TREE, TULIP-POPLAR (family *Magnoliaceae*). Native of eastern North America. Maximum height 200 ft. A noble species of pyramidal or oblong outline that in late spring bears large handsome, but not very conspicuous, tulip-like flowers which are green and white with an orange band near the bottom, inside each petal. Long after the flowers have fallen, their remains can be seen at the branch ends as light brown loose conelike or starlike attachments. The leaves are unlike those of any other tree except of its oriental relative, *Liriodendron chinense*. They are four-lobed and are saddle-shaped at their ends. In fall they turn bright yellow. The trunk is tall, straight, and extends into the crown. The tulip-tree needs fertile, fairly moist, well-drained soil. Except when young, it is rather difficult to transplant. It may be used as a shade tree, but it has the fault of being rather susceptible to storm and ice damage, and it begins dropping its leaves in late summer or early fall and continues doing so for a long period. The four rows of trees that border the approaches to the Museum Building of The New York Botanical Garden are tulip-trees. The wood, known as yellow-poplar, is soft and fine-grained. It is used for furniture, boat building, and veneer. The state tree of Kentucky.

14. Juglans nigra—BLACK WALNUT (family *Juglandaceae*). Native of eastern North America. Maximum height 150 ft. Characteristically straight-branched and round-headed with deeply ridged, almost black bark. Leaves alternate and pinnate. Flower greenish, the males in drooping catkins, the females in short spikes at branch ends in spring. Nuts large, thick-shelled, sweet, edible. A good shade and shelterbelt tree but difficult to transplant except when young. It thrives best in moderately moist, rich soil. Evidence supports the popular belief that it is difficult or impossible for many other kinds of plants to prosper under walnut trees, presumably because their roots exude a substance harmful to other plants. Its wood takes a fine polish and is highly valued for furniture, interior finish, and gun stocks. This is the state tree of Iowa.

15. Liquidambar styraciflua. See number 22.

16 and 17. Phellodendron lavallei—CORK TREE (family *Rutaceae*). Native of Japan. Maximum height 45 ft. A picturesque shade tree with wide-spreading branches and thick, corky, deeply fissured bark. Well adapted for use in small home landscapes and tolerant of city conditions. Its handsome deep green, pinnate leaves are marked with minute translucent dots as are those of most plants of the *Rutaceae*. They turn golden-yellow in fall. The tiny yellow-green flowers in large terminal panicles are followed by pea-like berries, at first green, becoming black when ripe. They taste strongly of turpentine. All parts of the tree are strongly aromatic. This tree prospers best in deep rich soil. It withstands transplanting well. ●

18. Carya ovata—SHAGBARK HICKORY (family *Juglandaceae*). Native of eastern North America. Maximum height 120 ft. A rather narrow oblong-topped tree. After it reaches its nut-bearing age it is usually characterized by numerous very conspicuous curved platelike strips of bark hanging loosely from the trunk. (This particular specimen has not developed this "shagginess" to any marked degree). Its compound leaves usually consist of 5 leaflets which turn yellow or yellow-brown in fall. The male flowers are in slender, drooping, branched catkins, the females in terminal spikes. Hickories are readily distinguished from walnuts by the solid pith in their twigs, whereas walnut pith is partitioned crosswise. This species thrives in a variety of soils but grows rather slowly. It is a fine ornamental tree but difficult to transplant except when young. Its thin-shelled, sweet, edible nuts are the hickory nuts of commerce. The hard, heavy wood is valued for tool handles, parts of vehicles, for smoking meats, and as fuel. ●

19. Gleditsia triacanthos—HONEY LOCUST, SWEET LOCUST (family *Leguminosae*). Native of eastern North America. Maximum height 140 ft. Graceful broad-branched, loose-headed tree with dainty pinnate or bipinnate foliage. Normally trunk and branches are decorated with large, stout, branched spines of exceedingly vicious appearance, but thornless varieties are cultivated. The spines are morphologically modified branches. The flowers are inconspicuous, not pea-shaped as in most hardy *Leguminosae*, usually unisexual, the sexes in separate racemes, and are followed by long curved or twisted pods containing several seeds surrounded by edible sweet pulp. The pods provide food for livestock. Valued as a shade and shelterbelt tree, the honey locust thrives in any ordinary soil, withstands drought well, transplants easily. The wood is used for fence posts, construction, furniture, and railroad ties.

20. Castanea crenata—JAPANESE CHESTNUT (family *Fagaceae*). Native of Japan. Maximum height 30 ft. An attractive tall shrub or small tree, resistant (but less so than the Chinese chestnut, *Castanea mollissima*) to the chestnut blight disease that destroyed the native American chestnut. The Japanese chestnut begins bearing when about 6 years old. Its nuts, smaller than those of our native *Castanea americana*, are an important food in Japan. The tree has been hybridized with native American castaneas in efforts to produce disease-resistant varieties, but most of those developed are less worthy than the best hybrids between the Chinese chestnut and American kinds. This tree thrives in any fairly good soil that is well drained.

21. Quercus palustris—PIN OAK (family *Fagaceae*). Native of eastern North America. Maximum height 120 ft. A favorite shade and street tree with, when young, a symmetrical rather narrow pyramidal head, and drooping lower branches, and in age a more irregular and oblong outline. Its foliage becomes brilliant red in fall. This oak grows fairly rapidly, is easy to transplant, and requires acid, moderately moist soil. Its wood is used for fuel, charcoal, shingles, and clapboards.

22. Liquidambar styraciflua—SWEET GUM (family *Hamamelidaceae*). Native of eastern North America, Mexico, and parts of Central America. Maximum height 140 ft. A magnificent ornamental tree of symmetrical, pyramidal, or rounded outline. Its slightly fragrant, glossy, maple-shaped leaves, which are alternate on the stems and not in opposite pairs like those of maples, turn a brilliant red in fall. The twigs are reddish, usually with corky ridges. The insignificant flowers appear in globular heads when the new leaves are partly grown. Male and female flowers are usually in separate heads. The females are followed by spiny ball-like fruits which hang on the tree throughout the winter. This tree is rather difficult to transplant, especially in clayey soils. It is resistant to storm damage and thrives in a variety of non-alkaline soils, best in moist but well-drained ones. A very important timber tree; its wood, known as redgum and sapgum, is used for furniture, interior trim, veneer, boxes, and millwork. This tree is the source of storax, a gum used in adhesives, salves, incense, and perfume.

23. Carya cordiformis—BITTERNUT (family *Juglandaceae*). Native of eastern North America. Maximum height 90 ft. A handsome ornamental of fairly rapid growth which forms a rather broad head. Its leaves, of 5-9 leaflets, turn yellow or yellow-brown in fall. Its flowers are essentially like those of the shagbark hickory (number 18). Its nuts have thinner husks than those of shagbark hickory. They are thin-shelled and bitter. Characteristic of this species is the bright yellow color of its winter buds. It thrives best in rich, moist soil but is difficult to transplant except

3. *Corylus colurna*

6. *Acer pseudo-platanus*

12. *Platanus acerifolia*

when young. The wood is used for the same purposes as that of number 18. •

24. Quercus palustris. See number 21.

25. Gymnocladus dioica—KENTUCKY COFFEE TREE (family *Leguminoseae*). Native of eastern North America. Maximum height 100 ft. A remarkable and picturesque tree which gives light shade and is attractive at all seasons. Its enormous leaves are twice pinnate, unfold late in spring, are first pink but soon turn bronzy green. They become yellow in fall and drop early. The flowers are unisexual or bisexual, greenish and in panicles. Unlike those of most hardy *Leguminosae*, they are regular rather than pea-shaped. The seeds are in large flat reddish pods which remain on the tree all winter. They have been used as a coffee substitute. This tree thrives in rich, moist soil. It is nowhere abundant in the wild. Its wood is handsome and suitable for cabinet work and is durable in contact with soil. •

26. Prunus persica 'Helen Borchers'—FLOWERING PEACH (family *Rosaceae*). Horticultural variety of the common peach, *Prunus persica*, which is a native of China. Maximum height 15 ft. A lovely, but comparatively short-lived, small spring-flowering shrub or tree that bears an abundance of clear pink flowers 2½ in. in diameter. It thrives best in light, well-drained, fertile soil in full sun and should be pruned rather heavily after flowering. •

27. Syringa amurensis japonica — (family *Oleaceae*). Native of Japan. Maximum height 30 ft. This unusual lilac, the latest to bloom and the only kind that becomes distinctly a tree, forms a pyramidal rather open head. Its leaves are larger and coarser than those of the common lilac. Its bark is glossy and much like that of a cherry tree. About mid-June or slightly earlier it produces massive panicles of ill-scented, small creamy white flowers. Although the panicles are much larger, they bear a resemblance to those of privet to which shrubs lilacs are botanically closely related. It thrives in any well-drained soil in full sun.

28. Picea pungens argentea — COLORADO SPRUCE variety (family *Pinaceae*). *Picea pungens argentea* is often misnamed Koster's blue spruce. The true Koster's blue spruce has drooping branches and a trunk which, if left unstaked, grows horizontally along the ground. The only difference between this and *Picea pungens glauca* (number 30) is that the foliage of variety *argentea* is more silvery.

29. Picea polita—TIGERTAIL SPRUCE (family *Pinaceae*). Native of Japan. Maximum height 120 ft. An ornamental, rather slow-growing, broad-pyramidal evergreen, symmetrical when young, more irregularly shaped later, distinct because of its stiff, spiny leaves that project from all around its rigid branches except on their under sides where a V-shaped trough or groove separates the foliage. A good kind for planting where space is somewhat limited. It requires the same culture as oriental spruce (number 33), and its wood is useful for the same purposes.

30. Picea pungens glauca — COLORADO SPRUCE variety (family *Pinaceae*). A variety of a species native of Colorado, Utah, Wyoming, and New Mexico. Maximum height 150 ft. This, one of several varieties of *Picea pungens* commonly known as Colorado blue spruce, is distinct and beautiful. It forms a symmetrical, conical head of stiff horizontal branches usually arranged in distinct tiers, has downy young shoots, and rigid, bluish spiny leaves (compare with Engelmann spruce number 39). Like other varieties of Colorado spruce, this thrives in the Northeast and is freely planted in gardens; but, like other varities too, it is at its best during its early life and after 15-20 years is likely to lose lower branches and become ragged. *Picea pungens* and its varieties are very susceptible to certain insect infestations. *Picea pungens glauca* differs from typical *Picea pungens* (the state tree of Colorado and of Utah) in that its foliage is more definitely bluish. The wood of *Picea pungens* and its varieties is similar to that of Engelmann spruce (number 39) and is used for the same purposes.

17. *Phellodendron lavallei*

18. *Carya ovata*

23. *Carya cordiformis*

25. *Gymnocladus dioica*

31. *Picea pungens viridis*

42, 43. *Picea orientalis (left)*
41. *Picea pungens glauca (right)*

31. Picea pungens viridis — COLORADO SPRUCE variety (family *Pinaceae*). The only difference between this and *Picea pungens glauca* (number 30) is that the foliage of variety *viridis* is green. ●

32. Picea omorika—SERBIAN SPRUCE (family *Pinaceae*). Native of southern Europe. Maximum height 100 ft. Rather narrow and pyramidal in outline and one of the hardiest spruces. It grows rather slowly. Its shoots are clothed with short stiff hairs. Its leaves, flat in cross section, are dark green with whitish lines facing the ground. Although facing downwards, the sides of the leaves with white lines are really the upper ones; as with all spruces, the leaves are twisted about 180 degrees. Serbian spruce is one of the very best for landscape use. It requires the same cultural conditions as oriental spruce (number 33). Its wood is used similarly.

33. Picea orientalis — ORIENTAL SPRUCE (family *Pinaceae*). Native of Caucasus and Asia Minor. Maximum height 120 ft. A handsome ornamental that resembles the Norway Spruce (number 8) in outline, but its branches are more slender and its leaves smaller. Its cones are purple when young, later brown. Oriental spruce grows more slowly than Norway spruce and is more compact. For these reasons it should be preferred for planting where space is limited. A fairly rich, moist, but not wet soil suits it best. Its wood is valued for the same purposes as that of Norway spruce.

34. Picea pungens glauca. See number 30.

35. Picea orientalis. See number 33

36. Picea pungens glauca. See number 30.

37. Picea orientalis. See number 33.

38. Picea pungens glauca. See number 30.

39. Picea engelmannii glauca — ENGLEMANN SPRUCE variety (family *Pinaceae*). Native of western North America. Maximum height 150 ft. This differs from typical Englemann spruce, *Picea engelmannii*, in that its foliage is more distinctly bluish. In other respects it is similar. It forms a narrow pyramidal head with rather slender, spreading branches. Its leaves are flexible and have a strong disagreeable odor when crushed. The young shoots are pubescent. (The closely related Colorado spruce, *Picea pungens*, differs in having hairless shoots and rigid spine-tipped leaves). This is one of the best spruces for planting in the Northeast and one of the most beautiful. It is extremely cold-resistant. It requires the same cultural conditions as oriental spruce (number 33). Its lumber is light, soft, close-grained but not strong. It is used for building, box-making, railroad ties, poles, and fuel. The bark is used for tanning.

40. Picea pungens viridis. See number 31.

41. Picea pungens glauca. See number 30. ●

42. Picea orientalis. See number 33. ●

43. Picea orientalis. See number 33. ●

44. Prunus persica variety — WEEPING FLOWERING PEACH (family *Rosaceae*). Horticultural variety of the common peach, *Prunus persica*, a native of China. This single-flowered variety is characterized by its pendulous branches. The remarks made regarding *Prunus persica* 'Helen Borchers' (number 26) apply to this variety, except that its flowers are smaller and are not double.

45. Fraxinus americana — WHITE ASH (family *Oleaceae*). Native of North America. Maximum height 120 ft. Round-topped or pyramidal. Its flowers have no ornamental merit. Its fruits, one-seeded winged samaras, form conspicuous drooping panicles. Like most ashes *Fraxinus americana* has pinnate leaves and large black winter buds. Ashes are among the few common trees that have opposite leaves. A good shade tree for fertile, fairly moist soils. It makes rapid growth

45. *Fraxinus americana*

46. *Quercus borealis*

48. *Chionanthus retusa*

56. *Quercus velutina*

57. *Betula lutea*

58. *Koelreuteria paniculata*

in its early years and is easy to transplant successfully. Its wood is heavy, tough, strong, and is greatly valued for making furniture, oars, tool handles, and for finishing interiors. •

46. Quercus borealis — NORTHERN RED OAK (family *Fagaceae*). Maximum height 75 ft. Native of eastern North America. A broad-spreading, round-topped tree with stout branches and large bristle-pointed leaves that turn dark red in fall. One of the commonest native oaks, it is a fine shade and street tree that grows rapidly and thrives in moist or dryish soil. Its acorn cups enclose about one third of the nut. An important lumber source, the wood is rather porous and not especially resistant to decay. After treatment with preservatives, it is used for railroad ties, and heavy construction. •

47. Celtis sinensis — HACKBERRY (family *Ulmaceae*). Native of China, Japan, and Korea. Maximum height 60 ft. This oriental relative of our native hackberries and of the sugarberry of our South makes a dense, stately, rounded tree but has no very special merit as an ornamental. Its foliage, like that of most hackberries, resembles that of their near botanical relatives, the elms. From elms hackberries are readily distinguished by their fruits which are berry-like, black, purple, yellow, or orange (orange in *Celtis sinensis*), whereas the fruits of elms are dry winged seed-cases (samaras). *Celtis sinensis* thrives in any ordinary soil. Its fruits are reported to be edible.

48. Chionanthus retusa—CHINESE FRINGE-TREE (family *Oleaceae*). Maximum height 30 ft. A rather rare tall shrub or small tree that in late spring bears a profusion of beautiful snow-white, fragrant flowers in broad panicles much shorter than those of our native *Chionanthus virginica*. The panicles terminate the ends of young shoots of the current year's growth, whereas those of the American kind arise directly from upper nodes of stems developed the previous year. The flowers are four-petaled and functionally male or female, not bisexual. This tree is closely related botanically to forsythia, lilac, and privet. The Chinese fringe-tree forms a choice lawn specimen when it has ample room to develop. A moist fertile soil and sunny location suit it. •

49. Abies veitchii — VEITCH'S FIR (family *Pinaceae*). Native of Japan and Manchuria. Maximum height 75 ft. One of the best firs for planting in the eastern states and, when young, one of the most beautiful. It was discovered originally growing on Mount Fujiyama by the English plant collector J. Gould Veitch in 1879. It forms a conical tree, easily distinguished from other firs by its narrow, abrupt-tipped leaves which are directed towards the tips of the branches and more or less curving upwards. They are green above and have bands of intense white beneath. The branchlets are minutely downy. The cones are purple before they ripen. Like those of all firs they are erect, whereas those of spruces hang downwards. Another difference between firs and spruces is that when leaves of the former fall or are pulled off, they part from the stem with a tiny piece of bark attached and leave a smooth scar; whereas spruce needles when detached from the branchlets leave short stubs. Cultural needs and lumber characteristics as for number 64.

50. through 55. Abies homolepis. See number 64.

56. Quercus velutina—BLACK OAK (family *Fagaceae*). Native of eastern North America. Maximum height 150 ft. This tree develops an open, narrow-oval, round-topped head. A fast grower, it thrives best in moderately moist soil. Its leaves, which are widest above their middles, have bristle-tipped lobes. When they unfold in spring, they are soft crimson; in fall they turn dull red and orange-brown. Like others of the black oak group, this species has acorns that ripen in their second year. The inner bark, the linings of the acorn cups, and the meat of the acorns are yellow, for which reasons the tree is sometimes called yellow oak. Its wood is one source of red oak lumber, its bark is used for tanning. •

57. Betula lutea—YELLOW BIRCH (family *Betulaceae*). Native of eastern North America. Maximum height 100 ft. A valuable round-headed forest and ornamental tree, with spreading, often more or less pendulous branches and lustrous, peeling, silvery grey or light orange bark which becomes reddish-brown with age. Bark of young branches is aromatic and somewhat bitter. The leaves are aromatic and turn yellow in fall. Male flowers are in drooping catkins, females in much smaller catkins succeeded by small cones which are conspicuous in fall and early winter. A moist, well-drained light soil suits this species. The wood, close-grained, hard, heavy, and strong, is used for furniture, flooring, boxes, bobbins, fuel, and distillation products. •

58. Koelreuteria paniculata—GOLDENRAIN-TREE (family *Sapindaceae*). Native of China, Korea, and Japan. Maximum height 30 ft. A fairly fast-growing, round-headed tree with fernlike pinnate or bipinnate leaves that do not color attractively in fall, and large panicles of small golden-yellow flowers in summer. The flowers are followed by big, brown, papery-walled, bladderlike pods that persist until fall. This splendid ornamental should be used more frequently in gardens. It thrives in any ordinary soil, is very drought-resistant, and needs a sunny location. A good specimen is located against the front of the Museum Building of The New York Botanical Garden to the left of, as one faces, the main entrance. This tree is planted in great profusion in New Harmony, Ind., and yearly a festival is held there when the trees are in bloom. •

59. Quercus phellos—WILLOW OAK (family *Fagaceae*). Native of eastern North America. Maximum height 100 ft. This splendid shade tree grows fast, is long-lived, and thrives in exposed locations and near the sea. It is easy to transplant and grows well in a variety of soils, but best in fairly moist ones. It forms a conical round-topped head and has long, narrow, unlobed willowlike leaves, very unlike those of most oaks. These turn pale yellow in fall. Belonging to the black oak group, this tree ripens its acorns in their second year. It is one source of red oak lumber. Its wood is strong and heavy. •

60. Populus alba—WHITE POPLAR, ABELE (family *Salicaceae*). Native of Europe and Asia. Maximum height 100 ft. A broad-headed, freely branching tree that grows rapidly and produces numerous sprouts from its roots. (Here, repeated mowing eliminates these.) The bark is whitish on younger branches, dark-colored on older parts. The leaves, es-

59. *Quercus phellos*

60. *Populus alba*

66. *Abies homolepis*

pecially early in the season, are white-woolly on their under sides. The flowers are in catkins in spring, the sexes on different trees. The female flowers are followed by cottony seeds. This tree grows freely in any ordinary soil and stands city conditions well, but is not highly regarded for landscape use because of its suckering habit, the tendency of its roots to invade drains, and the untidiness of its seeds. A narrow, erect variety, *Populus alba pyramidalis* (bolleana poplar) is planted freely on parkways, airports, and in other public places near the sea in the New York area. The wood of white poplar is soft, white, and light in weight. It is used for paper pulp, excelsior, building, and fuel. ●

61. Abies homolepis. See number 64.

62. Abies cephalonica—GREEK FIR (family *Pinaceae*). Native of Greece. Maximum height 100 ft. One of the most distinct and easily recognized firs, it forms a symmetrical conical specimen with smooth young shoots and rigid, almost spine-tipped leaves that point outwards at almost right angles from all around the stems, but are more numerous from their upper than from their lower sides. The upper leaf surface is green, the lower marked with conspicuous longitudinal white bands. The cones are brownish. Like other firs this kind is most ornamental when comparatively young. Cultural needs and lumber uses as for number 64.

63. Fraxinus americana. See number 45.

64 through 68. Abies homolepis—NIKKO-FIR (family *Pinaceae*). Native of Japan. Maximum height 100 ft. One of the most satisfactory firs for planting in the eastern states, this handsome species has a symmetrical, pyramidal head. Its young shoots are smooth. The leaves (shining green above, green with two longitudinal broad white bands beneath, and slightly notched at their tips) are in rows, the lowermost the longest and spreading horizontally and each succeeding row shorter and more erect, until the uppermost diverge to form a v-shaped trough along the top of the shoot. The cones are purple before they mature. Like other firs, this thrives best in a well-drained but moist soil and where it receives full sun but is sheltered from sweeping winds. Like other firs, too, it is most ornamental during its first 30-40 years; after that it tends to lose lower branches, become thin and straggly, and lose vigor. Its lumber is soft and perishable. ●

69. Abies nordmanniana—NORDMANN'S FIR. CAUCASIAN FIR (family *Pinaceae*). Native of Caucasus, Greece, Asia Minor. Maximum height 150 ft. This handsome fir is one of the most desirable for cultivation in the eastern states. It forms a conical specimen, most decorative during its first 30-40 years. Subsequently, it is likely to become straggly and lose lower branches. Its young shoots have short, stiff hairs. Its leaves are crowded and mostly from the upper sides of the shoots. As with Veitch's fir (numbers 49, 79, 85) the leaves are in rows, the lowermost longest and spreading horizontally, those above progressively shorter. Unlike Veitch's fir, except on very weak shoots no v-shaped trough separates the two upper rows of leaves. The leaves are glossy green above and have two white lines beneath. The cones are reddish-brown. Cultural needs and lumber characteristics as for Nikko fir (number 64).

70. Quercus cerris—TURKEY OAK (family *Fagaceae*). Native of southern Europe and Asia Minor. Maximum height 120 ft. Forms a broad pyramidal head when young, at maturity is often irregular in shape. This handsome species should be planted more frequently for shade and ornament. It grows quickly and has rich green foliage retained very late in fall, but dropping without coloring attractively. Its mossy-cupped acorns ripen in their second year. Its winter buds are distinctive because of the slender downy scales that surround them and are longer than they are. Although not hardy much north of New York City it prospers here. A very fine specimen is located near the road through the magnolia collection at The New York Botanical Garden. The wood is not valued as lumber. This species is the source of galls used in tanning and of oak manna or gaz which is used in Iran in the sweetmeat called gazenjubeen.

71. Acer pseudo-platanus. See number 6.

72. Aesculus hippocastanum—HORSECHESTNUT (family *Hippocastanaceae*). Native of the mountains of Greece and Albania. Maximum height about 100 ft. A noble tree with spreading branches, broad rounded head, and opposite leaves each having 5-7 leaflets that diverge like fingers of a hand. Its winter buds are large, brown, and sticky. It is one of the earliest trees to display spring foliage. The white-tinged-red flowers, borne abundantly and conspicuously in erect massive panicles in May, are followed by large prickly fruits, each containing 1-2 lustrous brown nuts. These, although inedible, have a remarkable fascination for small boys who are apt to be troublesome in their efforts to obtain them by throwing sticks and stones at the trees. Because of this, the non-fruiting, double-flowered variety named *flore pleno* is to be preferred for planting in public places. This is the "chestnut" so freely planted in Paris, France. It is also common as a street tree in London and many other European cities. It requires a deep, rich, moderately moist soil. Its wood is soft and weak.

73. Liriodendron tulipifera. See number 13.

74. Abies cephalonica. See number 62.

75. Abies nobilis—NOBLE FIR (family *Pinaceae*). Native of the Pacific Northwest. Maximum height 250 ft. One of the most satisfactory firs for planting in eastern North America. Conical when young, it tends to develop a broad rounded top at maturity. Its young shoots are clothed with fine down. Its leaves are closely set along the sides and top of the branchlets. The upper leaves have their bases flattened along the branchlets, completely hiding them. The cones, among the largest produced by any fir, are 6-10 inches long and stand erect. Its cultural needs are the same as those of *Abies homolepis* (number 64). Its wood is used for interior finishing, moldings, siding, millwork, venetian blinds, ladders, rails, boxes, and for paper pulp.

76. Acer platanoides—NORWAY MAPLE (family *Aceraceae*). Native of Europe and western Asia. Maximum height 100 ft. A favorite street tree and shade tree. Transplants easily, withstands pruning well. Forms a dense, spreading rounded head. In early spring bears conspicuous clusters of yellow-green flowers

followed by twin-winged fruits. When broken, the petioles exude a milky sap, a feature by which it is readily distinguished from the sugar maple which is somewhat similar in contour and foliage characteristics. The leaves of Norway maple do not color attractively in fall. Its wood is white, fairly hard, and close-grained.

77. **Fraxinus pennsylvanica** — RED ASH (family *Oleaceae*). Native of eastern North America. Maximum height 75 ft. Similar to green ash (number 1) but young branches, petioles, and panicles covered with dense reddish pubescence, and leaflets thinner and usually pubescent beneath. Culture and uses same as for green ash.

78. **Abies cephalonica.** See number 62.

79. **Abies veitchii.** See number 49.

80. **Fraxinus americana.** See number 45.

81. **Quercus macrocarpa**—BURR OAK, MOSSYCUP OAK (family *Fagaceae*). Maximum height 160 ft. Native of eastern North America. Usually a tall-trunked tree with spreading branches and a massive broad rounded head, but in some natural stands only a shrub. Its corky branches are conspicuous in winter and, like others of the white oak group, the leaves are without bristles tipping their lobes. In fall its foliage turns yellow or brown. Its acorns are large, their cups conspicuously fringed with many slender scales. It grows rather slowly, thrives best on moist fertile soil, but endures drought remarkably well. A good shade tree and used for shelterbelts. ●

82. **Pseudotsuga taxifolia** — DOUGLAS-FIR (family *Pinaceae*). Native of western America. Maximum height 300 ft. This splendid evergreen, the state tree of Oregon, is one of the most satisfactory coniferous trees to use as an ornamental. It grows rapidly (its hardier variety *glauca*—the Rocky Mountain Douglas-fir—more slowly than the type) and adapts itself surprisingly well to city conditions. It is pyramidal, its main branches horizontal, its secondary ones pendulous. Its young shoots are more or less downy. Its flexible, straight or slightly curved dark green or bluish green leaves are crowded in two opposite ranks or spread in all directions. They are rounded but not notched at their ends and have longitudinal grayish lines beneath. The cones are drooping, small, brown, and bristly. Douglas-fir thrives in any well-drained, moderately fertile soil. It is excellent as a Christmas tree and for shelterbelts. Named after David Douglas, the brilliant British plant collector who discovered it in the Pacific Northwest in 1830, this is one of America's most important and prolific sources of lumber. Its wood is used for building, plywood, piling, railroad ties, cooperage, fencing, flooring, crates and boxes, furniture, boats. ●

83 and 84. **Abies homolepis.** See number 64.

85. **Abies veitchii.** See number 49.

86 and 87. **Abies firma**—MOMI FIR (family *Pinaceae*). Native of Japan. Maximum height 150 ft. A broad pyramidal tree with rigid horizontal branches and dense foliage. The leaves are stiff, in two more or less horizontally spreading groups with a broad V-shaped trough separating them on the upper side of the branchlets. The leaves are green above, faintly marked with whitish bands below, and are distinctly notched at their tips. The grooves between the leaf bases of the young stems are pubescent. Cultural needs and uses of its lumber are the same as for number 49.

88. **Abies homolepis.** See number 64.

89. **Abies firma.** See number 86.

90 and 91. **Abies nordmanniana.** See number 69. ●

92. **Liriodendron tulipifera.** See number 13.

93. **Betula lenta**---CHERRY BIRCH, SWEET BIRCH (family *Betulaceae*). Native of eastern North America. Maximum height 75 ft. A fine pyramidal tree that becomes round-topped at maturity. It has glossy reddish bark resembling that of a cherry. The crushed bark of young branches smells and tastes agreeably of wintergreen. The flowers are in catkins in spring, males and females separately. The female catkins are succeeded by small cones, conspicuous after the leaves fall. The foliage turns beautiful yellow in fall. This ornamental tree thrives best in fairly moist soil. It is the source of an oil similar to and with the same uses as oil of wintergreen. Birch beer is obtained by fermenting its sap. Its wood is valued for the same purposes as that of yellow birch (number 57).

94 through 108. **Pseudotsuga taxifolia.** See number 82.

109 and 110. **Ulmus americana**—AMERICAN ELM, WHITE ELM (family *Ulmaceae*). Native of eastern and central North America. Maximum height 120 ft. One of the best-loved and best-known native trees and the state tree of Massachusetts. Characteristically it develops a trunk that divides at 10-30 feet above the ground into a number of major, more or less equal limbs which reach upwards and arch gracefully outwards to form a beautiful round-topped, vase-shaped head. Occasionally specimens occur with erect, undivided trunks and sometimes individuals (as number 109) are feathered down their trunks with short, drooping side branches. Elm leaves are boldly veined, have saw-toothed margins, and are unequally lobed at their bases. Neither flowers nor fruits have any ornamental merit. The latter are dry, elliptic, flat, and winged. The foliage turns yellow in fall. The American elm was long favored, and rightly, as one of the finest avenue and shade trees. Especially in New England entire towns and villages depended upon it, and rows of magnificent specimens give character to numerous communities. But this majestic species has fallen upon evil times. The so far uncontrollable Dutch elm disease (that has caused frightful destruction to elms in and around New York City, including The New York Botanical Garden as well as elsewhere) and the elm phloem necrosis disease (that is even more deadly and has been particularly destructive in the Middle West) are so threatening that many gardeners and landscape architects are wisely refraining from planting American elms at least until, if ever, acceptable control for these scourges is discovered. American elm thrives best in rich, fairly moist soil. Its wood is heavy, hard, and tough. It is used for furniture, vehicle parts, dairy, poultry and apiary supplies, boxes, baskets, crates, and barrels.

81. *Quercus macrocarpa*

82. *Pseudotsuga taxifolia*

91. *Abies nordmanniana*

THE BOTANICAL GARDEN AS AN OUTDOOR LABORATORY FOR TAXONOMY

By WILLIAM CAMPBELL STEERE

Dr. Steere is Director of The New York Botanical Garden. This paper, one of four in a symposium entitled "The Botanical Garden as an Outdoor Laboratory for Teaching," was presented on August 30, 1960, before the Teaching Section of the Botanical Society of America at its annual meeting at Oklahoma State University, Stillwater, at the invitation of the Chairman of the Section, Professor Harriette V. Bartoo.

IN THIS SYMPOSIUM to discuss the significance of "The Botanical Garden as an Outdoor Laboratory," I have been asked to speak on the botanical garden as a taxonomic tool. My primary problem is that I take so for granted that a botanical garden *is* a taxonomic tool that I can't imagine a contrary situation—and nothing is more difficult to prove convincingly than the obvious! Serious convictions, of course, are not necessarily based on logic or even on facts, as we see so well demonstrated during the current election year. To be forced by necessity to explore the anatomy of my conviction that a botanical garden is almost by definition a taxonomic tool, and that a so-called botanical garden or arboretum without teaching and research interests is only a park, provides healthy self-discipline for me.

My other serious difficulty in preparing and presenting this paper is the necessity for isolating only one element from as highly complex and diversified an operation as The New York Botanical Garden. We have such live and active interests in all the four areas of this symposium, that we could have provided experienced staff members to give all four papers. However, the chairman showed great wisdom in selecting a panel of participants from four different institutions and thereby bringing an even broader spectrum of experience to this discussion of the complicated, subtle, and sometimes frustrating aims and activities of botanical gardens.

The functions of botanical gardens from earliest times have been several and diverse, ranging from the purely aesthetic to the purely applied. The basic proposition of all botanical gardens, however, is a collection of plants, and so we immediately perceive the need for some sort of systematic arrangement of the plants from which taxonomy naturally develops. It is no accident that the important centers of taxonomic research and teaching grew up around the various great botanical gardens of Europe. The mention of Kew, Berlin-Dahlem, Copenhagen, and many other place-names brings to the mind of educated people the thought of some great botanical garden. To the botanist, these cities also coincide with centers of outstanding taxonomic research.

The early recognition of relationships among plants and the consequent development of the concept of families and orders of plants arose long before the advent of the theory of evolution and our present-day ideas of phylogeny, just from the evidence of observing many kinds of plants growing together in botanical gardens.

The large botanical gardens of the world, then, combine with their recreational and park functions the creative research potential made possible by enormous collections of living plants outdoors and under glass. Financially, The New York Botanical Garden is a sort of double-headed monster that carries on many of its recreational and park activities with the support of funds derived from the City of New York, whereas its educational, research, and publication programs are financed almost entirely with the income from endowment and other funds from private sources. Quite to the contrary, Kew and most other important European botanical gardens are supported completely by their national governments, yet are encouraged financially to carry on their extensive programs of original investigation. The New York Botanical Garden must find support for its research activities by obtaining grants of funds from the National Science Foundation, the National Institutes of Health, the Atomic Energy Commission, the Office of Naval Research, and other federal and private agencies and foundations. Funds for teaching are likewise derived from gifts, grants, tuition, and from sources other than the City of New York.

The official statements of two important botanical gardens with reference to their primary functions are germane to this symposium and especially appropriate to the topic of my assignment. I have chosen the Royal Botanic Gardens, Kew, and The New York Botanical Garden not only because they are well known to everyone, but also because the magnificent facilities at Kew seventy years ago inspired the founding of The New York Botanical Garden.

The *Illustrated Guide to Kew* says: "Kew Gardens, it must be remembered, primarily serves scientific purposes. The Institution has as its main objectives the accurate identification of plants and the provision of information in the field of botany, both pure and applied...."

"By a large proportion of those who come to Kew, it is thought of rather as a place of recreation than as a scientific institution, but valuable as the former service is, it must be appreciated as a by-product of the Institution's main purpose, and therefore the usage of the gardens by the public must not be allowed to hamper its chief functions as a scientific establishment. Fortunately, the proper safeguarding of the living collections and their efficiency is the best guarantee that the public will obtain the maximum enjoyment from them without detriment to botanical science."

In an appreciation of "The scientific work of Nathaniel Lord Britton" (Proceedings, American Philosophical Society 104: 205-226. 1960) Dr. H. A. Gleason points out emphatically how little the purpose of The New York Botanical Garden today has changed from its original intent in the beginning. A small brochure circulated by the Torrey Botanical Club in 1889 states, according to Gleason, "The use of a botanic garden may be reckoned as of four sorts. First and foremost is the purely scientific and educational use. Subsidiary to this, but still of a marked degree of importance, are the pharmaceutical and horticultural

uses, and lastly, the general use as a place of agreeable resort for the public at large." Even though the wording might be somewhat different today, the spirit remains the same—we are fundamentally and primarily a scientific research institution. The resemblance of the basic philosophy of The New York Botanical Garden to that of Kew, in the insistence on the importance of the research function, is not sheer coincidence. As you may know, the first idea of creating a great American botanical garden came to the mind of Dr. Britton and his wife when they visited Kew in 1889. The statement just quoted was undoubtedly written by Dr. Britton and was just as undoubtedly inspired by a parallel and contemporary policy statement at Kew.

The first botanical gardens were collections of plants for useful purposes and for recreation. Collections of medicinal plants several centuries ago led to the production of herbals that described the plants and their uses. The herbals, in turn, led to more accurate descriptions of plants and to the first stirrings of modern taxonomy. The Chelsea Physic Garden in London, like many of its sister institutions, was established for growing medicinal plants and for initiating potential medical practitioners into the mysteries of materia medica—and today it is still used for teaching taxonomy to medical students.

The systematic gardens at Kew and in other European botanical gardens are excellent tools for self-instruction in taxonomy a well as for formal teaching purposes. One sees many visitors in them, both students and adults, busily occupied with taking notes. In my own opinion, the systematic arrangement of plants in some area of a botanical garden is of utmost importance, in spite of disparaging and irreverent remarks about "botanical graveyards," and the admitted tendency of even closely related plants to conflict in size and shape, and for their flower colors to clash.

Browsing through the systematic plantings of the University of Michigan Botanical Garden, while I was still a high school student, gave me an early understanding of plant families that made my university work much easier. Many years later, as a staff member at the University of Michigan, I occasionally taught a course dealing primarily with the identification of the local flora, under the somewhat grandiose title of "Systematic Botany." It was only natural that I chose to use the Botanical Garden as an outdoor teaching laboratory—as a source of material of living plants to be studied individually, and to illustrate family characteristics. Seeing related plants together—and alive—helps students to understand the concept of plant families and other major taxa more easily than any other method I know. Curiously enough, The New York Botanical Garden is one of the few large, research-oriented institutions without an outdoor garden arranged in systematic order. However, plans for remedying this lack of a teaching facility have been made by T. H. Everett, Assistant Director (Horticulture) and Curator of Education, and planting has already been begun by Louis Politi, Horticulturist.

The use of botanical gardens as outdoor laboratories for taxonomy falls into several categories based on the intellectual level and the degree of motivation of the users, as follows:

1. *The casual learning of the names of a few trees or other plants by the inspection of labels in a park, arboretum, or botanical garden.* Any botanical garden, even of the smallest size, can satisfy this "idle curiosity" function, although it should, of course make some attempt to create and to stimulate a real interest. Carefully planned, informative labels are a "must" at this level.

2. *The motivated learning through self-teaching or through organized courses and educational programs of the names of horticultural and native plants by serious amateurs.* This is a more serious responsibility of botanical gardens, which requires very considerable preparation and activity by professional staff members. During the past two summers, The New York Botanical Garden has conducted a Summer Institute in Botany for gifted high school students, in which the students were introduced to the field of taxonomy among other botanical topics.

3. *Formal teaching for credit, at the high school or undergraduate college level, whether for students taking a general program or for those planning to enter the field of botany or some related science.* In any elementary course in botany or biology, the botanical garden is truly an excellent outdoor laboratory for teaching the various types of plants, and their structure and modifications, as related to taxonomy. For more advanced courses that center on taxonomy, the identification of plants, learning the local flora, becoming acquainted with the major plant families, and learning something about the basis of phylogeny, class work in a botanical garden or arboretum is so highly desirable as to be essential.

4. *The professional training of graduate students, either for some background in taxonomy or for actual specialization in this field for advanced degrees, as the master's or doctor's.* This level of teaching and the continuing research in taxonomic problems by staff members place the highest requirements on botanical gardens, and it is in these areas, as already pointed out, that the great botanical gardens of the world function most effectively. I grew up in the immediate vicinity of the University of Michigan Botanical Garden and spent much time there during my formative years. It was no accident, then, that I used its facilities to grow the plants for my own doctoral thesis and eventually became a member of its staff. Seeing this Botanical Garden during its "golden years" between 1925 and 1935 left an indelible impression on me concerning the responsibilities of botanical gardens as teaching and research centers. Professor Harley Bartlett must be given great credit for his vigorous encouragement of graduate-student training by means of collections of living plants, and for attracting other researchers by the facilities of the University of Michigan Botanical Garden, of which he was director. Probably no educational center in the United States could match at that time the diversity or the intensity of the active investigation of the taxonomy, cytotaxonomy, and cytogenetics of living plants collected specifically for such studies. Those were the years of intensive research, for example, on *Oenothera* by H. H. Bartlett, B. M. Davis, Frieda Blanchard, Sterling Emerson, and others; on *Rosa* by Eileen Erlanson; on *Zea mays* by E. G. Anderson and Marcus Rhoades; on *Petunia, Salpiglossis,* and *Solanum* by E. E. Dale; on *Solanum, Nicandra,* and other solanaceous genera by Janaki-Anmal; on *Ambrosia* by K. L. Jones. After the great de-

pression, which reduced the financial support and activities of this botanical garden, the earlier momentum was never regained.

The University of California Botanical Garden likewise based outstanding taxonomic work on collections of living plants. Many doctoral students contributed to the brilliant work on *Crepis* by Babcock and Stebbins and on *Nicotiana* by Goodspeed and his associates. The Arnold Arboretum has long been a center of taxonomy and cytotaxonomy of woody plants, based on the great and relatively complete collections well suited for such investigations. The active program of plant exploration supported by the Arnold Arboretum has made as great an impact on plant taxonomy as on horticulture.

If I had any fault to find with the training of graduate students in taxonomy at The New York Botanical Garden, it would be that they are not encouraged—or required—to bring together living materials of as many as possible of the species of the group upon which their doctoral work centers. Even though plants grown away from their native environment and climate may not necessarily develop in a completely typical manner, they still contribute enormously to an understanding of the taxonomy of any group. Of course, it would be foolish of us to try to furnish a student with mature living examples, side by side, of all the species of some genus of tropical trees; but I would hope that we could make it possible for him to visit one of the great tropical botanical gardens. However, to avoid giving any impression that The New York Botanical Garden has been delinquent in amassing collections of living plants for research in taxonomy and related areas, I shall remind you of the magnificent four-volume monographic treatment of the *Cactaceae* by Britton and Rose, based in large part on living material in the Garden's conservatories. A. B. Stout's important and long-continued work on taxonomy, cytology, and selection in *Hemerocallis* provides another outstanding example of staff research on living plants.

Most of the great botanical gardens of the world, in addition to their collections of living plants, also maintain excellent library facilities and a herbarium of dried reference specimens, representing not only the plants growing in the garden but also plants from all parts of the world. In fact, the four primary facilities of any botanical garden that is actively engaged in research and education in plant sciences are the collections of living plants (both out of doors and under glass), the library, the herbarium, and the laboratory.

Specialized botanical gardens have a more restricted usefulness than large, general gardens, but by their very specialization may be enabled to go farther in their chosen direction than the more diffuse general garden can. The Fairchild Tropical Botanical Garden near Miami, Florida, is an excellent example. The magnificent collection of palms and cycads brought together by Colonel Robert Montgomery, first on his own estate and later at the nearby Fairchild Garden, which he founded, is by far the best taxonomic tool for palm specialists in continental North America. The Santa Barbara Botanic Garden and the Rancho Santa Ana Botanic Garden, with their emphasis on the native plants of California, provide an easily accessible source of research material for the visiting botanist. Many other types of specialized gardens occur in this country, for the collection and demonstration of cacti and other succulents, Bible plants, herbs, medicinal plants, roses, native plants, and so on; each one, in its own way, provides an important taxonomic resource for teaching and research. The many specialized collections of horticultural varieties of crop plants originated and maintained for applied research by various branches of the U. S. Department of Agriculture and by various federal and state agricultural experiment stations likewise provide an important research potential for taxonomic research.

In summary, the effectiveness with which a botanical garden may serve as a taxonomic tool varies in direct proportion with the richness of its collections. A small collection of native plants serves as a useful device by which to teach the local flora to students and to interested lay persons. A more sophisticated collection of plants with a broader geographic scope will lend greater depth and range to the teaching and, of course, to the learning. In order to serve as a research tool, the botanical garden must have both specialized and representative collections that, in addition to all the other responsibilities, may reflect the specific research interests of individual staff members and of graduate students. The number of botanical gardens that have budgets adequate for the support of research collections is unfortunately much too small in every country. However, the increasing contribution to the community by botanical gardens, together with the increasing public interest in gardening, in conservation, in camping, in outdoor recreation, and in photography has brought with it a growing interest in plants, which, with proper nutrition and focus, we hope will lead to better public support of botanical gardens in general.

VIBURNUMS THROUGH THE YEAR

By DONALD R. EGOLF

Dr. Egolf is Cytogeneticist at the United States National Arboretum, Washington, D.C.

THE OLD-FASHIONED snowball, or guelder-rose, and the black-haws of the roadside and thicket are among the commonly known species of the diverse and adaptable genus *Viburnum*. It comprises more than one hundred and seventy-five species in the north temperate zone of both the eastern and western hemispheres. Although the native American species may not equal their Asiatic cousins in flower and fruit, they do include several of the most adaptable forms. The species extensively cultivated are natives of Asia, Europe, or North America. When conditions permit further plant exploration, there will undoubtedly be additional select introductions from other native habitats.

The genus *Viburnum* is a member of the *Caprifoliaceae*, the honey-suckle family, which includes also *Lonicera, Sambucus, Weigela, Kolkwitzia, Abelia,* and *Symphoricarpos*. *Viburnum* most closely resembles *Sambucus,* the elder, in the flower and the arrangement of flower and fruit. Viburnums are shrubs or small trees, deciduous or evergreen, and have naked or scaly buds, opposite, simple leaves, and small white or pinkish white flowers in cymes or panicles. The fruit is a one-seeded drupe, usually blue, black, or red.

The diploid (2n) chromosome numbers of *Viburnum* range from 16 to 72, forming several polyploid series. These complements are composed of several basic genome groups with the basic numbers (n) of 8, 9, and 10. Most of the species, including those native to the United States, have a basic number of 9 group and have a diploid (2n) chromosome number of 18 or a multiple thereof. The species with 8 and a diploid number of 16 or higher polyploid are restricted to Asia and are characterized by having a panicle such as is found in *V. fragrans* and *V. sieboldii*.

Viburnums are sturdy shrubs which, because of their hardiness and variability, are used extensively in northern landscape plantings for mass or specimen effect.

Most species can be propagated by one or another technique—the taking of cuttings or divisions, grafting, layering, or sowing seeds. Seeds, layering, grafting, and hardwood cuttings were the basic methods of propagation until the advent of interrupted mist propagation; now softwood cuttings have become the major method for asexual propagation. The number of plants desired and the facilities available will determine the propagation procedure adopted by the home gardener. If only a few plants are required and there are no propagation facilities, they can be secured by division of the sucker shoots that often appear near the base of the plant. A vigorous young branch, wounded with a slight cut in the bark near the tip and buried in soil, will strike roots the first season; but it will probably benefit by not being severed from the parent plant and transplanted until the second season.

Grafting is commonly practiced with *V. carlesi*, which is veneer-grafted or shield-budded on the seedling understock of *V. lantana*. Such techniques produce a salable plant in a shorter period of time but do not always please the home gardener. The objection to a grafted plant is the competition that develops between the stock and cion as the plant matures. The keen plantsman may recognize the difference between stock and cion and be on constant vigil with the pruning shears; but the amateur, unaware of understock growth, may realize after a few years that he has a plant of *V. lantana* and not *V. carlesi* or one of the other hybrids. In addition to the competition between stock and cion, there is always the matter of compatibility and differential growth-rate of the two.

Plants are propagated by cuttings or seed if a larger number is required. Six-to-eight-inch hardwood cuttings taken in late fall will be rooted late the following spring. Softwood cuttings made in mid-June through July will be well rooted in three weeks or less, depending on the species. The early-rooted cuttings will be well established by fall and will be less susceptible to winter injury.

Seed germination is complicated by dormancy or by inhibitors of the embryonic root and shoot. A warm pre-treatment of the seed at 20° C (68° F) will induce root development. If, after a prescribed time lapse, the seed is exposed to 5° C (41° F), the epicotyl, or shoot, will develop. Sowing seed in outdoor beds or pots in early summer and allowing them to freeze the following winter will simulate the warm period followed by a cold period that initiates germination. If the seed cannot be sown until late summer the length of the warm pre-treatment may be insufficient, and germination will not be achieved until after the second exposure, that is, after the second winter. Since viburnums will not come true from seed, and many inferior plants may be grown for each good one, it is recommended that propagation be carried on asexually by cuttings, layering, or grafting.

The majority of the species are not fastidious about soil but thrive somewhat better on heavy loam with a pH of 6.0 to 6.5. There are, however, the exceptions, such as *V. acerifolium, V. furcatum*, and *V. lantanoides*, that prefer a moist, organic soil with a more acid reaction in the range of pH 4.5 to 5.0. *V. cassinoides, V. dentatum, V. lentago,* and *V. scabrellum* are well adapted to moist areas, whereas *V. acerifolium, V. lantana, V. opulus, V. prunifolium,* and *V. rafinesquianum* are adaptable to both shady and dry conditions. Many species will benefit by partial shade; but, in general, the fruiting forms will produce best if they are in full sun for most of the day.

Once they are properly established, the viburnums demand little maintenance, as they are practically free from insects and diseases. If sulphur or sprays containing sulfur should come in contact with the foliage, it will cause rapid defoliation. Many recognize *V. opulus* and its cultivars by the distorted leaves and branchlets that have resulted from extensive aphid infestations. Sprays of lindane or mala-

The pale pink flowers of *Viburnum fragrans* are borne at the ends of spurs.

thion before the leaves have curled will readily control aphids. Mildew, which may be troublesome in late summer, can be controlled with a karathane spray. Bacterial leaf-spot is seldom prevalent enough to disfigure the foliage on susceptible members of the Lantana group. A Bordeaux mixture or some ready-made copper fungicide will prevent the spread of this disease.

On a bleak winter day the pendulous red fruit of *V. trilobum,* the American cranberry-bush, or of *V. opulus,* the European cranberry-bush, is a welcome sight in the garden mounded with snow. This fruit is not readily eaten by birds and will remain on the plant until late winter. Other species such as *V. prunifolium*, blackhaw: *V. lentago*, nannyberry: *V. acerifolium,* maple-leaved viburnum: and *V. dilatatum*, linden viburnum, provide a winter source of food for wildlife and will encourage birds to remain nearby to enliven the winter scene. Of course, the winter fruit cannot rival that of the autumn in its brilliant display, but what other shrub can be so admired in midwinter?

The deciduous viburnums form a diverse structural frame-work for the winter landscape. The habit of growth largely determines how useful a plant is for twelve months in the landscape rather than for only a few months in summer or fall when in flower or fruit. The landscape architect may choose from an array of growth-habit forms such as the picturesque, gnarled branches and trunk of *V. sieboldii;* the horizontally tiered branches of *V. plicatum tomentosum,* and *V. prunifolium*; the globose medium shrub of *V. carlesi or V. dilatatum*; or the dwarf cushion-form of *V. opulus nanum* or *V. fragrans nanum.* Viburnums have many characteristics that make them desirable for use as specimens, as trimmed or informal hedges, as mass plantings or as small trees.

The few evergreen species hardy in northern areas may provide accent in winter. Unless *V. rhytidophyllum* (6)*, the leather-leaf viburnum, is in a well-protected location, the windswept foliage may droop sadly on cold days, and even fall from the plant; but in a sheltered situation the eight-inch-long, deeply rugose leaves on a well-grown eight-to-twelve-foot plant can be a feature of the garden throughout the year. The cream-white flowers are showy for only a few days in early May. In late summer the green fruit provides a striking contrast as it matures and changes from red to black. The plant will be semi-evergreen as far north as Boston. The cultivar *V. rhytidophyllum roseum* will display the pink color only in the buds. The hybrid *V.* × *rhytidophylloides* 'Willow Wood' (6), *V. rhytidophyllum* × *V. lantana,* is somewhat hardier but will defoliate much earlier in the season. This wide-spreading plant may attain a height of fifteen feet. The semi-evergreen *V. buddleifolium* (6) has eight-inch-long, pale green, soft, velvety-textured leaves. This plant from central China will thrive in areas south of Philadelphia, but in more northern areas it will often be killed to the ground by low temperatures. The evergreen *V. utile* (6), one of the parents of the well-known *V.* × *burkwoodi* (5b), is a graceful, fine-textured, compact shrub which rarely grows more than five feet high. The small, glossy, green leaves are densely yellow-gray-pubescent beneath, as are the naked winter buds and the young branchlets. In late April the fragrant white flowers are very similar to those of *V. carlesi*, but slightly less fragrant. This choice Chinese species was introduced by Wilson in 1901; it deserves more extensive cultivation.

Few other evergreen species can endure the winters of the Northeast. In a sheltered patio corner, *V. tinus* (7b), the laurustinus, *V. odoratissimum* (8), *V. japonicum* (7), or *V. davidii* (7b) may thrive. Even in protected areas along the East Coast, one can expect these species to be somewhat injured during severe weather. *V. tinus*, the laurustinus, is a large globose shrub of twelve feet or more in its native habitat in southern Europe and northern Africa, but in the Northeast it will seldom be more than four feet high. The white blooms of late fall, winter, and early spring appear after a few warm days. The interesting but not effective metallic-blue fruits remain on the plant for an extended period. The large, ovate, glossy, green leaves and abundant red fruit clusters of *V. japonicum* combine to provide a

This is a mature, free-flowering specimen of *Viburnum rhytidophyllum.*

first-rate plant. The heavy-textured, lustrous dark green, six-to-eight-inch leaves of *V. odoratissimum* are borne on a plant which in a mild climate or protected location may obtain a height of ten feet. This plant will seldom flower or fruit, but it is worthy of cultivation for its handsome foliage. The panicles of fragrant white flowers are followed by brilliant red fruits which turn black. Of all the evergreens, *V. davidii*, David's viburnum is one of the choicest; it has many meritorious characteristics. The leathery, dark green, six-inch, three-veined leaves make this low plant useful for foreground planting and for planters. The white flowers in early spring are not outstanding but add to the merit of the plant. The briliant metallic-blue fruits persist on the plant for much of the year but are not conspicuous. This species was discovered by Abbé Armand David in Mapin in Western Szechuan, China, and was introduced into cultivation by Wilson in 1904.

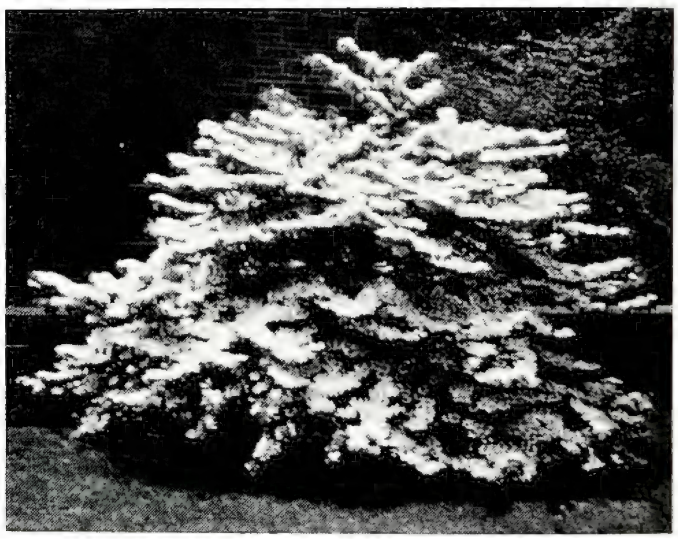
The appearance of the pale pink, sweetly scented flowers of *V fragrans* (5b) in late March or early April is a sign that spring is arriving. The plant may flower sparsely on twiggy growth, but since it appears before *Forsythia* and *Cornus mas*, it is highly esteemed. A ten-foot specimen with arched branches is handsome in flower or foliage. Reginald Farrer, who introduced this plant from Kansu, China, gives an exuberant account of his first encounter with it in his book *On the Eaves of the World.* The white-flowered form, *V. fragrans alba* (5b), has slightly larger flowers but these tend to be more susceptible to injury by freezing. The dwarf compact *V. fragrans nanum* will seldom exceed two feet in height and is a choice foreground or low hedge plant. Young plants usually flower sparsely. The fruits, secluded by the dense foliage, mature in early summer and are readily eaten by the birds. Although the variety is hardy in northern areas, the flower buds may be winter-injured and then few flowers appear the following spring, or those that open early will turn brown. The plant is flower-bud-hardy in southern New York if planted in a sheltered, sunny location. This is one of the most neglected viburnums and one that should be more extensively cultivated.

V. grandiflorum (6), a native of the Himalayas, is unknown in cultivation in the Northeast. The larger, deep rose flowers will not endure so much frost as *V. fragrans* (5b). A mature *V. grandiflorum* plant may be ten feet high and a compact, globose specimen, but young plants tend to be leggy and sparse-flowering. This plant has been hybridized with *V. fragrans* to produce the hybrid *V.* × *bodnantense.* The inflorescence, foliage, and growth-habit are intermediate between those of the parents; however, the hybrid is hardier than *V. grandiflorum.*

V. foetens (7) can be grown south of Philadelphia, but the waxy white flowers of late winter and early spring may be disfigured by freezing. The leaves have a pungent odor when crushed or decaying, which is also characteristic of several other members of the genus. This five-foot plant is much admired for its early bloom, but will not thrive unless it is in a protected corner.

With the advance of spring the species with cymes of tubular white or pink florets highlight the landscape. *V. carlesi* (5), the fragrant or Korean spice viburnum, is a five-foot plant known to many. In late April the clusters of pink buds change to white as the flowers open; they resemble those of trailing arbutus in both shape and fragrance. A semi-shady situation is necessary for maximum growth and flower. *V. carlesi compacta* (5b) is a recently introduced dwarf form that should be more suitable for the small garden. A number of species and hybrids have an inflorescence similar to that of *V carlesi. V.* × *burkwoodi*, a hybrid of *V. carlesi* × *V. utile*, has glossy, semi-persistent foliage. *V. chenaulti* (5) is a similar hybrid, but has smaller leaves of a finer texture. The open, thinly branched *V. bitchiuense* (6) produces sweetly fragrant flowers in early May; a mature specimen may be as much as ten feet tall. The cross of *V. bitchiuense* and *V. carlesi* yielded *V. juddi* (6), which is intermediate between the parents in size of inflorescence. The habit of growth more closely resembles that of *V. bitchiuense.* The English introduction, *V.* × *carlcephalum* (5b), is relatively new in this country; it has proved a noteworthy ornamental. *V. carlesi* was crossed with *V. macrocephalum* (7) to produce the hybrid of robust, somewhat coarse habit of growth. The large clusters of clove-scented, white flowers lack the refinement and quality of *V. carlesi.*

The hobblebush *(V. alnifolium)* (4), which inhabits



The horizontal, tiered branches of *Viburnum plicatum tomentosum* are accentuated by abundant flowers.

the moist, acid woodlands of the Northeast, is one of the spectacular species in flower. The large inflorescence is composed of fertile florets encircled by a marginal ring of enlarged sterile florets and creates a Queen-Anne's-lace pattern in the late April woodland. Unfortunately, this choice native is difficult to cultivate unless the soil conditions approximate those of its native habitat. The six-inch, orbicular, deeply rugose leaves are ornamental throughout the season, but they are especially outstanding when red in the autumn. The name hobblebush is derived from the tangle of stems (which develop from underground shoots or by layering of the branches) that trips the traveler or causes him to hobble.

(To be continued)

*The number after the species in the text refers to the hardiness zone according to *Plant Hardiness Zone Map*, U. S. Dep. Agr. Misc. Publ. 814. The suffix b with the hardiness zone indicates that the plant is hardy only in the warmer parts of the zone.

Hybrid Teas in a bed edged with sweet alyssum and climbers on the wooden fence that encloses this informal rose garden.

LANDSCAPING WITH ROSES

By MARY H. STOCK

Miss Stock majored in design at the School for Horticulture for Women, at Ambler, Pennsylvania, now Ambler Junior College, a division of Temple University. After working for a year in her father's nursery in Bethesda, Maryland, she attended the University of Georgia from which she received B.S. degree in landscape architecture in June 1958. Since then Miss Stock has been developing a landscape practice from her home in Rockville, Maryland.

ONE OF THE FIRST pictures that often comes to my mind in thinking of a rose garden is a formal garden unit of a large property or estate. Can you recall such a garden from your experience? One of the loveliest series of gardens I have seen is the Old Westbury Gardens on Long Island, New York. The English architect George Crawley designed the eighteenth-century house and associated formal gardens to blend with the countryside.* The series of gardens includes a rose garden through which one walks under a brown wooden trellis with pink roses climbing overhead and the blue sky filtering through.

We are fortunate in maintaining outstanding older gardens of this country where inspiration can be gained to create today's gardens. The principles of design remain the same whether applied to our public and institutional buildings or to our own backyards.

In the effective use of roses or any other plant in the landscape, people have drawn on a few age-old design principles, principles which apply in many other creative fields. These principles relate to unity, scale, color, form, line, texture, and balance. The principles are applied in varying measure by architects, interior designers and decorators, dress designers, and others.

Let us take a practical example: suppose you have moved into a new house. You have decided to extend your living space, but you want privacy from neighbors, a terrace for outdoor entertaining, a beautiful view from the picture window, roses, and many other things. This requires organization—organization in relation to your needs, in relation to your budget, in relation to the physical aspects of your property, and, to an extent, in relation to conditions on adjacent properties. The first principle is *unity*. To reflect this unity the rose bed should be in some way related to the terrace, to other plantings, or to the house.

The second principle relates to *scale*. Scale is a size and quantity relationship which exists among people and the things and areas they use. For example, public parks and municipal rose gardens are generally designed on a large scale with large rose beds and wide walks to accommodate many people without crowding. A garden in a residential development serves a smaller, more intimate group. The garden reflects the habits and characteristics of the owners for whom it is designed. Even if on some lots it is im-

*See information pamphlet, Westbury House, published by Old Westbury Gardens, P.O. Box 265, Westbury, Long Island.

possible to achieve the space actually necessary for many activities, it is possible to achieve space visually. Their gardens reflect a different culture from ours and a populous country, but the outstanding artists in visual scale are, in my opinion, the Japanese. As you read ahead, you will find that scale can be influenced by the use of color, form, line, and texture.

A third design principle relates to *color* and its use. Dark colors shaded grey recede, while bright colors and white come forward. Anyone who has ever been south to Florida in late winter, then returned north to Washington, D. C., or a northern state to see the delicate hues of early spring is more than usually appreciative of seasonal change and color. However, light, reflection, and shadow are also involved in this third principle. For example, in the South, along the coast of southern Georgia, the wide open marshlands are dramatized when contrasted with the deep shade of live oaks hung with Spanish moss.

Color and light also relate to stone work and buildings. Let us suppose someone wants to plant a climbing rose against a stone house. What color should he choose? In a house in which the stone is predominantly gray, there may also be stone with a purple or yellow cast. If the stone has a purple cast, a yellow floribunda climber such as 'Goldilocks' could be used for contrast, as yellow and purple are complements. If there is yellow in the stonework, an analagous color combination could be worked out—perhaps a two-toned climbing Hybrid Tea such as 'Peace' would be planted. The same approach would be used when planting against brick.

Bricks are toned orange, purple, and red with varying tints and shades. Although there are exceptions, where difficult-to-combine colors are used together successfully, the complementary, analagous, and monochromatic hues are most certain to please.

Another word to consider in relation to landscaping is *form*. Form relates to the shape of things. Flowers have form both in the individual florets and in their grouping.

This formal rose garden has a small pool and charming statue as focal points and an effective evergreen background.

The flowers of roses, as those who grow and enjoy them know, vary in form individually and according to type. Buds of Hybrid Teas generally are longer and grow singly, while Floribundas do not have such long buds and grow in clusters. As a group the Floribundas tend to be lower-growing than the Hybrid Teas. The Grandifloras combine characteristics of both the Hybrid Tea and the Floribunda. Then there are the climbers, which vary not only in flower form but in the habit of growth, plant form, and amount of bloom. There are tree roses, whose form is determined by the method of propagation. In using plant and rose forms

Boxwood and an octagonal English sundial are features of the sunken rose garden in Old Westbury Gardens on Long Island.

effectively in the landscape, we think first of the form desired, then whether it can be achieved by a single plant or a mass of plants. If a single climbing plant is desired, it could be a climbing rose. If a mass effect is desired, roses could be chosen to achieve it. Floribundas and Hybrid Teas can be used to face down a wall or fence. They can be used as foreground planting in front of taller evergreens, if environmental conditions are good. If the evergreen planting is too tall and casts shadow or if it competes too much for soil nutrients, an evergreen background might still be achieved by having a wide walk or lawn area between the rose bed and the background planting. In these cases the height of the fence, wall, or evergreen planting is decreased visually. When you are landscaping with roses, try thinking first of the form of the planting and then of the roses that can be used to achieve it.

A fifth word to consider in relation to landscaping is *line.* Line is movement. It is caused by a change in material or texture, a change in form, or a change in light and dark or color.

Texture is the way an object "feels." It can be sensed visually. Some materials such as concrete can be given different textures. Plant textures may be described as fine, medium, or coarse, depending on the size and placement of the leaves and their relative smoothness. Relative degrees of fineness and coarseness tend to vary, depending on the materials combined. Roses generally are medium- or fine-textured. Because roses are deciduous, they are used to give variety and interest. Remembering their form and shape, you may use shrub roses as you would deciduous shrubs. Roses can be used as background for lower-growing coarser evergreens to create distance.

Lastly, a garden must have *balance.* There are symmetrical and asymmetrical balances. The formal boxwood-edged rose garden with paths, sundial, and bench is usually and basically symmetrical. However, asymmetrical elements are often introduced as a foil to the symmetrical. For instance, an existing tree may be incorporated in the garden plan. A tree or garden house quite frequently gives vertical balance to an area planted in low-growing plants. The relationship that the tree and planted area bear is also one of scale and form.

Balance also relates to color. For example, a small amount of bright red has more balancing strength than a larger area of pale pink.

If an attempt were made to rate roses in comparison with other plants in terms of these design principles, they would undoubtedly rate best in color. Even, if a rose were chosen for its ability to affect scale, for its plant form, or for its contribution to the design in some other way, its high rating for color would still most likely determine its selection. Generally speaking, roses bloom most dramatically in early summer, with scattered blooms through the summer; then in the fall there is another colorful display. Their colors range through white, pink, red, bi-color, orange, and yellow. Although some varieties clash, others can be grouped harmoniously in the same bed. Some combinations that I like are: 'Mohave', 'Sutter's Gold', and 'Eclipse': and a bed of the pink Grandiflora 'Queen Elizabeth', with a stretch of lawn behind and dogwood; this is especially lovely when the dogwood is in autumn foliage. I like the purple *Clematis jackmanii* near red roses such as 'Chrysler Imperial' or 'Nocturn.' Roses can be incorporated in a perennial bed for color accent, and tree roses can be used in a perennial bed for accent achieved through form as well as color.

In existing gardens, either in actuality or in picture, and in the natural landscape, you can observe unity; you can appreciate scale; and you can see color, form, line, texture, and balance. Then perhaps you will be better able to incorporate these elements into your own landscaping efforts, or at least recognize the lack of existence of good design.

NEW LIBRARY FACILITIES

Under the leadership of Mrs. Hermann G. Place, and thanks to the personal generosity of its members and other friends, and to substantial grants of funds from the National Science Foundation, the Avalon Foundation, The Rockefeller Brothers Fund, and the James Foundation, The New York Botanical Garden had in hand on July 1, 1960, pledges of more than half a million dollars toward the cost of constructing new library facilities. Newbold Morris, in his first months as Commissioner of Parks, made a strong and successful request to the Board of Estimate for matching funds, so that in *The City Record* for January 3, 1961, containing the 1961 New York City Capital Budget, one finds the budget item of $585,030, to be matched by $552,000 in private funds. Our new library, to take the form of a wing attached to the present Museum and Administration Building, should be under construction during the second half of the present year. To all who have helped bring this dream to reality go our appreciation and gratitude.

APPOINTMENT OF ASSISTANT DIRECTOR (Botany)

Dr. Pierre Dansereau, Dean of the Faculty of Science and Director of the Botanical Institute of the University of Montreal since 1955, will become Assistant Director (Botany) of The New York Botanical Garden on April 1, 1961. His appointment was announced on February 20, 1961, by Charles B. Harding, President of The New York Botanical Garden.

Dr. Dansereau pursued graduate studies in botany and agriculture in France and engaged in taxonomic and cytological research on the genus *Cistus* at the University of Geneva, Switzerland, at the Royal Botanical Gardens in Kent, Surrey, England, at the Botanical Museum and Garden in Berlin, Germany, and at the Botanical Institute of Florence, Italy. In recent years he has engaged in ecological investigations in Brazil, New Zealand, Australia, Spain, Portugal, and other countries.

An internationally distinguished botanist, Dr. Dansereau has been accorded many honors and awards in his own country and abroad.

In the March-April, 1958, issue of *The Garden Journal,* Dr. Murray F. Buell of Rutgers University, in reviewing Dr. Dansereau's book, *Biogeography. An Ecological Perspective,* described him as "America's most cosmopolitan plant ecologist."

NEW CURATORIAL TITLE

At its regular meeting on February 20, 1961, the Executive Committee of the Board of Managers of The New York Botanical Garden established a new curatorial title, The Nathaniel Lord Britton Distinguished Senior Curatorship, in honor of the first director of the Garden, to be financed in part from a recent bequest from the estate of Richard Britton, a brother. Dr. Bassett Maguire has been chosen as the first recipient of this honor.

BRIEF NOTES ON RECENT BOOKS

By Elizabeth C. Hall

Miss Hall is Sarah Gildersleeve Fife Research Librarian of The New York Botanical Garden.

General Gardening And Landscape Design

THE BEDFORD GARDENER'S ALMANAC FOR WESTCHESTER AND NEARBY COUNTIES. The Bedford Garden Club. 133 pages, illustrated, bibliography. The Bedford Garden Club, Bedford, N. Y. 1960. $2.75

"Advice for Beginners and Reminders for the Experienced" runs the sub-title of this compact, attractive thesaurus of gardening information, gleaned from books, lectures and articles of the Club's members over the past fifty years. A perfect guide for those gardening within a fifty-mile radius of New York City.

THE GARDENER'S ALMANAC; TIMELY HINTS FOR TIMELY GARDENERS. Farrington, Edward I. 144 pages, illustrated, indexed. Massachusetts Horticultural Society, Boston, Mass. 1960. $1.00

Sections for gardeners in the South and on the West Coast have been added to this welcome twelfth edition of an old favorite, which originated way back in 1939. It has been ably edited by George Taloumis.

GARDENS IN WINTER. Lawrence, Elizabeth. 218 pages, illustrated, bibliography, indexed. Harper and Bros., New York, N. Y. 1961. $4.50

Although Miss Lawrence writes from her garden in Charlotte, North Carolina, her delightful book contains "winter garden" reports from her many gardening friends in New England, Ohio, the West Coast, the South, and other points of the compass. Elizabeth Lawrence is one of our finest writers of garden books; her style and knowledge of plants are not unlike those of the late Louise Beebe Wilder.

STUDIES IN LANDSCAPE DESIGN. Jellicoe, G. A. 112 pages, illustrated, indexed. Oxford University Press, New York, N. Y. 1960. $4.00

Seven chapters based on lectures given by the author in Europe and America. The first two are historical, the next two deal with the influence of the ancient forces on the contemporary landscape, and the last three are concerned with landscape objectives and problems, specifically in England. Mr. Jellicoe is one of Britain's most eminent landscape architects.

SUNSET GARDEN AND PATIO BUILDING BOOK. 174, 96, 96, 96, 112 pages, illustrated. Lane Publishing Co., Menlo Park, Cal. 1960. $6.95

Five complete Sunset books in one volume: *Patio Book; Garden Work Centers; How to Build Patio Roofs; Walls, Walks,* and *Patio Floors; How to Build Fences and Gates.* Generously illustrated with photographs, construction plans, and diagrams. A most useful "do-it-yourself" encyclopedia.

TAYLOR'S ENCYCLOPEDIA OF GARDENING: HORTICULTURE AND LANDSCAPE DESIGN. Taylor, Norman, ed. 4th ed., 1329 pages, illustrated, part colored. Houghton, Mifflin Co., Boston, Mass. 1961. $15.00

The past splendid reputation of this encyclopedia serves as a strong endorsement. Its comprehensive fourth edition, updated, enlarged, and completely revised, includes new plants, new methods, revised nomenclature, forty-eight pages of fine color illustrations and over five hundred drawings in black-and-white. An authoritative, non-technical reference work in one volume for the layman gardener.

THERAPY THROUGH HORTICULTURE. Watson, Donald P. and Alice W. Burlingame. 134 pages, illustrated, bibliography, indexed. The Macmillan Co., New York, N. Y. 1960. $4.95

Horticultural therapy is no longer in the experimental stages. In a relatively short time it has attained professional status and now plays an important role in hospitals and convalescent homes throughout the country. Dr. Watson and Mrs. Burlingame have made a real contribution in presenting this authoritative manual, a storehouse of detailed information and advice on this important subject.

Garden Plants

AFRICAN VIOLET VARIETY LIST. Rector, Carolyn K. 113 pages. Whitlow's Book Store, San Pedro, Cal. 1960. $2.50

"Contains all the registered varieties which have been published previous to January 1st, 1960. Many of the older unregistered varieties have been omitted." A stupendous compilation of over six thousand entries with data as to color, leaf type, size of plant, type of flower, name of hybridizer (when known).

ALL ABOUT BEGONIAS. Brilmayer, Bernice. 223 pages, illustrated, part colored, bibliography, indexed. Doubleday and Co., Garden City, N. Y. 1960. $4.95

For amateurs by an amateur begonia hobbyist who states in her introduction: "*All About Begonias* makes no scientific pretense. Precise botanical terms, classifications and history are bypassed in favor of the language of the amateur." For the home grower of begonias this will be a helpful text. The list of commercial sources of seeds and plants is excellent.

THE BEST OF REDOUTÉS ROSES. Mannering Eva. xvi pages, 29 colored plates. Viking Press, New York, N. Y. 1959. $10.00

A selection from the famous folio work '*Les Roses*' that was published in the years 1817 to 1824. Redouté painted from the living roses in the Empress Josephine's gardens at Malmaison. There are brief descriptive notes in French.

THE BIBLE HERB BOOK. O'Brien, Marian M. 111 pages, illustrated, indexed. Bethany Press, St. Louis, Mo. 1960. paper: $1.95; cloth: $2.95

The food editor of the St. Louis Globe-Democrat gives brief cultural notes on the growing of herbs, but the greater part of her little book is given over to their various uses. She limits her selection of herbs to those mentioned in the Bible and frequently adds an appropriate quotation from the Bible. In addition to tempting food recipes, she gives instructions for making tisanes, pomanders, tussie mussies, potpourri, sachets, and herbal baths and rubs.

CAMELLIA, ITS APPRECIATION AND ARTISTIC ARRANGEMENT. Adachi, Choka. Translated from the Japanese by Hamae Okamoto and Davis Barrager. 278 pages, illustrated, part colored, bibliography. Perkins Oriental Books, Los Angeles, Cal. 1960. $25.00

In the introduction, the late Ralph S. Peer, internationally known camellia connoisseur, has written: "Throughout the book, one is struck by the fact that this is not simply a collection of fine photographs in color—it is an effort to express the Purity and Nobility of the Camellia." The Japanese author of this beautiful volume modestly states that he is neither a scholar nor a gardener, yet he has given the reader wonderful glimpses of the camellia in literature, art, history, legend, and economic uses. He devotes a section to illustrations of the culture of dwarfed "Higo-Camellia" and over one hundred pages of text and plates to the art of Japanese flower arrangement.

THE CARE AND CULTIVATION OF INDOOR PLANTS. Stevenson, Violet. 159 pages, illustrated. Philosophical Library, New York, N.Y. 1959. $4.75

Miss Stevenson, popular English author and lecturer, restricts her scope to plants that can be grown indoors under "normal living conditions." A very readable text with a helpful "Plant Treatment Chart."

CHRYSANTHEMUMS. Thistlethwaite, Edward T. 168 pages, illustrated, indexed. Penguin Books, Baltimore, Md. 1960. $1.45

A Penguin Handbook by a former secretary of the National Chrysanthemum Society [of Great Britain]. "Based on practical experience and on the knowledge of the troubles of others."

FLOWERS IN COLOR. Schwarzenbach, Hans. unpaged, 60 colored plates, indexed. Viking Press, New York, N. Y. 1960. $20.00

A companion folio volume to *Decorative Trees and Shrubs*, published in the early part of 1960. The original French text was written by W. Rytz and translated and adapted by Herbert L. Edlin. Sixty lithographic plates of native flora of Europe and America, arranged by plant family, and accompanied by an interesting, non-technical text. A beautiful gift book.

GETTING STARTED WITH RHODODENDRONS AND AZALEAS. Clarke, J. Harold. 268 pages, illustrated, colored front., bibliography, indexed. Doubleday and Co., Garden City, N. Y. 1960. $4.95

A compact little volume with an abundance of easily assimilated cultural advice, recommended varieties for special conditions, and excellent chapter on history and hybridizing.

HERBS: HOW TO GROW THEM AND HOW TO USE THEM; 6th ed. Webster, Helen Noyes. 204 pages, illustrated, indexed. Charles T. Branford Co., Newton Centre, Mass. 1959. $3.50

A tried and true favorite by a former president of The Herb Society of America; in this new edition a chapter has been added on Biblical herbs.

MAMMILLARIA. Marsden, C. 407 pages, illustrated, part colored, indexed. (Cacticulture Series Book II) St. Martin's Press, New York, N. Y. 1960. $7.75

An important title from England for cactus specialists. Over two hundred and fifty species are described and discussed. Sir Oliver Leese, in the foreword, writes: "Mr. Marsden is to be congratulated on the immense amount of valuable and accurate information he has provided."

RHODODENDRONS AND AZALEAS; THEIR ORIGINS, CULTIVATION AND DEVELOPMENT; 2nd ed. Bowers, Clement G. 525 pages, illustrated, part colored, bibliography, indexed. The Macmillan Co., New York, N. Y. 1960. $25.00

A most complete and definitive work on rhododendrons and azaleas. Since the first edition appeared in 1936, great advances have been made in the knowledge of these plants; in this revised edition Dr. Bowers has recorded the findings and opinions of many specialists as well as given us the benefit of his own observations and research.

TREASURES OF THE GARDEN. Huxley, Anthony J. 95 pages, illustrated, part colored. Hanover House, Garden City, N. Y. 1959. $4.95

A charming collection of flower photographs, many of which depict parts of the flower under high magnification. An animated text gives spicy bits of floral history. Translated and adapted from *'Belles Fleurs de Nos Jardins.'*

Plant Diseases

PLANT DISEASE HANDBOOK; 2nd ed. Westcott, Cynthia. 825 pages, illustrated, bibliography, glossary, indexed. D. Van Nostrand Co., Princeton, N. J. 1960. $13.50

"The Plant Doctor" has done it again, which means that she has produced another excellent, comprehensive work. In this completely revised and updated edition she has described more than two thousand plant diseases and has included the recent findings on nematodes and virus diseases with up-to-date information on garden chemicals. It has been ten years since the first edition appeared. For amateur and professional this is a "must" for the reference shelf.

Regional Books

THE ADIRONDACKS: AMERICAN PLAYGROUND. Sleicher, Charles A. 287 pages, illustrated, bibliography, indexed. Exposition Press, New York, N. Y. 1960. $3.00

The author who has summered in the Adirondack country for many years is an ardent enthusiast of that part of New York State. He has written a delightfully chatty chronicle of the history, people, geography, geology, and fauna of the region, but unfortunately, he devotes only six pages to the trees with hardly any mention of the native flowers.

BIRTH OF A NATIONAL PARK IN THE GREAT SMOKY MOUNTAINS. Campbell, Carlos C. 155 pages, illustrated, indexed. University of Tenn. Press, Knoxville, Tenn. 1960. $5.00

A documented account of the long struggle against political bias, apathy, and selfishness which resulted in the creation of one of our finest national parks, situated in the high mountains bordering North Carolina and Tennessee. Mr. Campbell was in the midst of this controversy. For more than twenty years he has served as secretary to the Great Smoky Mountains Conservation Association, the organization that "inspired" the project.

DOORYARD SUPERMARKET IN THE TROPICS AND SUBTROPICS; ITS DEVELOPMENT AND INSTRUCTIONS FOR FABRICATION AND USE OF ITS PRODUCTS. Perry, Ann M. 433 pages, illustrated, bibliography. Tropical Works, Fort Lauderdale, Fla. 1960. $7.50

A manual for amateur gardening newcomers to the tropics and subtropics by a newspaper columnist who has authored numerous articles on gardening in the lower South. Within the covers of this book is considerable information on growing and using ornamental plants, vegetables, and fruits and many hundreds of recipes.

DRAWINGS OF BRITISH PLANTS: BEING ILLUSTRATIONS OF THE SPECIES OF FLOWERING PLANTS GROWING NATURALLY IN THE BRITISH ISLES. Part XV. Compositae (1). Ross-Craig, Stella. 28 plates, indexed. G. Bell and Sons, London. 1960. $1.40

Species of the genera *Eupatorium, Solidago, Bellis, Aster, Erigeron, Filago, Antennaria, Gnaphalium, Inula, Pulicaria, Bidens,* and *Galinsoga.* The work of one of Britain's foremost botanical artists.

HAWAII BLOSSOMS. Hargreaves, Dorothy and Bob Hargreaves. 64 pages, illustrated in color, bibliography. Hargreaves Industrial, Portland, Ore. 1958. paper: $2.00; cloth: $3.50

Over 100 illustrations in color of trees, shrubs, vines, and other plants growing in Hawaii. A brief descriptive text often includes specific locations.

HAWAIIAN FLOWERS AND FLOWERING TREES; A GUIDE TO TROPICAL AND SEMITROPICAL FLORA. Kuck, Loraine E. and Richard C. Tongg. 158 pages, illustrated in color, indexed. Charles E. Tuttle Co., Rutland, Vt. 1960. $2.45

An inexpensive, soft-cover edition with identical contents as the clothbound which was published in 1958. A most useful, well-illustrated guide for travelers in the tropics and subtropics.

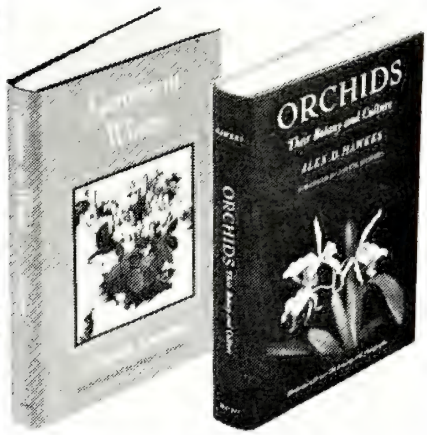
HIGH SIERRA MOUNTAIN WONDERLAND. Wampler, Joseph C., W. F. Heald, and Charles McDermand. 122 pages, illustrated, bibliography. Joseph C. Wampler, Berkeley, Cal. 1960. $2.00

Flowers, mammals, birds, fishes, geology, and weather of the country of the famous John Muir Trail in California—a most informative guide by three westerners who know and love these mountains. Good historical background.

MEET THE SOUTHWEST DESERTS. Welles, Philip. 82 pages, illustrated, bibliography, indexed. Dale Stuart King, Globe, Arizona. 1960. paper: $1.00; cloth: $2.25

This booklet is an introduction to the plant

Admirable new books for gardeners



GARDENS IN WINTER

By ELIZABETH LAWRENCE, author of *The Little Bulbs.* Miss Lawrence, as the *Chicago Tribune* says, "writes enchantingly, betraying her own enthusiasm while imparting fundamental information." In her new book she gives practical advice on how to extend bloom and color beyond the fall frosts and how to start it ahead of spring. Here are ideas for the South, New England, the Central States, the West Coast — plants effective against a wall, species for sheltered corners, evergreens and vines for color. And Miss Lawrence combines fresh suggestions with notes on customs and uses of the past. *26 line drawings by* CAROLINE DORMON. $4.50

ORCHIDS

Their Botany and Culture

By ALEX D. HAWKES. The Editor of *Orchid Journal* and *Orchid Weekly* presents the most comprehensive, up-to-date, popular book in the field. For the beginner, it offers concise guidance on where orchids are to be found, classification and naming systems, housing, care, and propagation. For experienced orchidists, it treats in detail more than 100 genera, covering native range of favorite species, common characteristics, requirements for cultivation, and hybridization. "A wealth of information in a clear and understandable manner ... I liked very much his treatment and arrangement of the whole complex subject." — FRANK H. OVERTON, Former Editor, *The Bromiliad Bulletin. 150 black-and-white photographs and drawings; full-color frontispiece.* $6.95

Incomparably useful

ARRANGING FLOWERS FOR THE SANCTUARY

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and animal life in the Southwest desert country below forty-five hundred feet elevation. Philip Welles grew up in the Sierre Madre and studied at the University of Arizona and is at present with the National Park Service. Good photographs.

MY WILDERNESS; THE PACIFIC WEST. Douglas, William O. 206 pages, illustrated. Doubleday and Co., Garden City, N. Y. 1960. $4.95

A dramatic, sympathetic account of the great out-of-doors as experienced by our "walking Justice" who has tramped through vast wildernesses from the Sierras in California north to the Olympics in Washington. A wonderful antidote for that pent-up feeling.

THE OXFORD BOOK OF WILD FLOWERS. Ary, S. and M. Gregory, eds. 232 pages, illustrated, mostly in color, indexed. Oxford University Press, New York, N. Y. 1960. $7.50

Rarely do we come across such a superb book which is useful to the layman-lover of native plants. Arranged by color sequence, non-technical text, and a comfortable size. Five hundred and fifty species of the wild flowers of the British countryside are exquisitely and accurately illustrated in soft, full color and thirty more in black and white, with many less common ones described in the text. Although definitely slanted for use in Great Britain, a suprisingly large number of these flowers from across the sea also grow in American fields and gardens.

TROPICAL BLOSSOMS OF FLORIDA. Hargreaves, Dorothy and Bob Hargreaves. 64 pages, illustrated in color, bibliography. Hargreaves Industrial, Portland, Ore. 1960. paper: $2.00; cloth: $3.50

Over one hundred full-color pictures with brief descriptive notes of tropical Florida flora. This booklet is identical with *Tropical Blossoms of the Caribbean* except for the title.

TROPICAL BLOSSOMS OF THE CARIBBEAN. Hargreaves, Dorothy and Bob Hargreaves. 64 pages, illustrated in color, bibliography. Hargreaves Industrial, Portland, Ore. 1960. paper: $2.00; cloth: $3.50

This booklet is identical with *Tropical Blossoms of Florida* except for the title.

YOUR GARDEN IN THE SOUTH. Mason, Hamilton. 358 pages, illustrated, part colored, bibliography, indexed. D. Van Nostrand Co., Princeton, N. J. 1961. $7.75

This is a book to recommend to the northerner who is moving south to Florida, Alabama, Georgia, Louisiana, Mississippi, or eastern Texas. The author writes: "You can have some of the North's favorite plants in parts of the South, but the farther you go into warm territory, the fewer you can have. You will learn . . . that lilacs, lily-of-the-valley, peonies must become fond memories. But what an enormous wealth of plants you have to replace them." Fruit and nut trees, ornamental trees, shrubs, vines, perennials, annuals, and lawns are well covered, but there is no mention of vegetables.

Economic Plants

THE MANGO; BOTANY, CULTIVATION, AND UTILIZATION. Singh, Lal Behari. 438 pages, illustrated, part colored, bibliography, indexed. Interscience Publishers, New York, N. Y. 1960. $13.25

Another welcome addition to the World Crops Books Series, edited by Nicholas Polunin. Mr. Singh, who is the Director of the Horticultural Research Institute, Saharanpur, Uttar Pradesh, India, has produced an up-to-date, noteworthy monograph on this important tropical fruit.

PRODUCING FARM CROPS. Wilson, Harold K. and A. Chester Richer. 336 pages, illustrated, bibliography, indexed. Interstate Printers and Publishers, Danville, Ill. 1960. $4.50

A textbook on modern methods of cultivation, designed primarily for high school agricultural students, written by experienced teachers of the Pennsylvania State University. A good discussion of the history, botany, genetics, and chemistry of grain and fodder crops is included.

THE WINE COUNTRY OF FRANCE. Hyams, Edward. 208 pages, maps, indexed. J. B. Lippincott Co., Philadelphia, Pa. 1960. $4.50

Well known as a novelist, Edward Hyams is also a viticulturist with an extensive vineyard in East Kent. Here is a rare combination of fine writing on a subject concerned with beautiful country and delectable wines.

Nature Study

BACKYARD BIRDS. Thomas, Arline. 46 pages, illustrated, part colored, bibliography, indexed. Sterling Publishing Co., New York, N. Y. 1960. $1.00

A little handbook of birdhouses, feeders, food preferences, first-aid hints for injured birds. Excellent line drawings, diagrams, and a few photographs in color of our common birds.

FAMILIAR INSECTS OF AMERICA. Barker, Will. 236 pages, illustrated, part colored, bibliography, indexed. Harper and Bros., New York, N. Y. 1960. $4.95

Companion book to the author's *Familiar Animals of America*—interesting reading and excellent illustrations.

A GATHERING OF SHORE BIRDS. Hall, Henry Marion. 242 pages, illustrated, bibliography, indexed. Devin-Adair Co., New York, N. Y. 1960. $10.00

Roland C. Clement of the staff of the National Audubon Society has edited this work and added valuable data on migration and behavior of the shore bird family. Here is a fine combination of popular and scientific presentation.

THE NEW HANDBOOK OF ATTRACTING BIRDS; 2nd ed. McElroy, Thomas P. 262 pages, illustrated, bibliography, indexed. Alfred A. Knopf, New York, N. Y. 1960. $4.00

The first edition appeared in 1950 under the title *Handbook of Attracting Birds*. The present revision is much enlarged.

WILDFLOWERS OF NORTH AMERICA. Lemmon, Robert S. and Charles G. Johnson. 280 pages, illustrated in color, bibliography, indexed. Hanover House, Garden City, N. Y. 1961. $9.95

The four hundred and forty color photographs are the work of Charles C. Johnson and his wife, who travelled over two hundred thousand miles throughout continental United States to locate and take pictures of America's best-known native wildflowers. The text was written by Robert S. Lemmon, from whose pen have come many fine books. This present volume is divided into five main sections: 1. The Coastal Region; 2. The Deserts of the Southwest; 3. The Mountains; 4. The Prairies; 5. The Woods. We have had few books of our native flora with such a wide scope, and this combination of splendid photographs and accurate text should find many followers.

THE WONDERS I SEE. Terres, John K. 256 pages, illustrated, bibliography, indexed. J. B. Lippincott Co., Philadelphia. 1960. $5.00

Fascinating observations from the daily journal of the former editor of *Audubon Magazine*, delightful reading of plant and animal life. For the most part, Mr. Terres writes from his home on Long Island, but there are frequent treks up through New England and down to Florida.

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For Young Readers

ABOUT APPLES FROM ORCHARD TO MARKET. Mary Moore Green. 31 pages, colored illustrations. Carl J. Leibel, Puente, Cal. 1960. $2.50

A young child can learn much from this story of the seasonal operations in a modern apple orchard in Michigan. Pruning, spraying, fertilizing, harvesting, grading, storing and shipping are some of the routine jobs. Pleasingly illustrated.

ABOUT THE VEGETABLES ON YOUR PLATE. Allee, Veva Elwell. 32 pages, illustrated, Carl J. Leibel, Puente, Cal. 1960. $2.50

"Look, read, learn" series. First steps in botany from everyday vegetables with a little bit on shipping, storing, dehydrating, canning and freezing.

ADVENTURE BOOK OF FOREST WONDERS. Evans, Eva Knox. 94 pages, illustrated, indexed. (in "Adventure Kit of Forest Wonders"). Affiliated Publishers, New York, N. Y. 1960. Adventure kit with book: $2.95

The "Adventure Kit of Forest Wonders" contains a well-illustrated paper-bound book, full of interesting facts about trees and of suggestions for doing experiments, such as making paper, starting wood specimen collections. The kit contains samples of wood pulp, wheat paste, peat planting pot with tree seeds, and other equipment. This book can be obtained only at bookstores.

THE GOLDEN BOOK OF NATURE CRAFTS: HOBBIES AND ACTIVITIES FOR BOYS AND GIRLS. Saunders, John R. 68 pages, colored illustrations, bibliography. Affiliated Publishers, New York, N. Y. 1958. $1.95

Wonderfully well-done by the Chairman of the Department of Public Instruction of The American Museum of Natural History. Plant subjects include: "Window Gardens from Kitchen Cuttings," "Making Leaf Prints," "Eggshell Gardens," "Make Seeds Sprout," "Making a Desert Garden Indoors," "Let's Go Nutting." This book can be obtained only at bookstores.

GRASSES. Eberle, Irmengarde. 56 pages, illustrated. H. Z. Walck, New York, N. Y. 1960. $2.75

A simple storybook for ages seven to ten about some members of the grass family, such as rice, corn, wheat, and bamboo as well as the "true" grasses.

HIGH TIMBER; THE STORY OF AMERICAN FORESTRY. Coombs, Charles I. 224 pages, illustrated, indexed. World Publishing Co., Cleveland, Ohio. 1960. $4.95

A serious book for the "teen-ager" with particular emphasis on the importance of trees, their many uses, their conservation, and their classification. Duties and qualifications of a forest ranger are discussed at length.

HOW A SEED GROWS. Jordan, Helene J. unpaged, illustrated, part colored. Thomas Y. Crowell Co., New York, N. Y. 1960. $1.95

A "beginning-to-read" picture book.

HOW THINGS GROW. Zim, Herbert S. 64 pages, illustrated. William Morrow and Co., New York, N. Y. 1960. $2.50

The many ways of growth in plants and animals are described and illustrated in a manner to hold the interest of young children.

IN MY GARDEN. Zolotow, Charlotte, unpaged, illustrated, part colored. Lothrop, Lee and Shepard Co., New York, N. Y. 1960. $2.75

Another picture book for the very, very young.

INSTRUCTIONS TO YOUNG BOTANISTS. Duddington, C. L. 128 pages, illustrated, bibliography, glossary, indexed. Sportshelf, New Rochelle, N. Y. 1960. $3.75

Dr. Duddington, a teacher of botany in London, has written a good introduction to the study of plants and covers such subjects as morphology, physiology, simple classification, plant distribution, and collecting.

JOHNNY APPLESEED. Norman, Gertrude. 45 pages, illustrated. G. P. Putnam's Sons, New York, N. Y. 1960. $2.00

The story of how Johnny Appleseed (John Chapman was his real name) went west into the Ohio territory and broadcasted his apple seeds wherever he traveled. For the beginning reader.

JUNIOR SCIENCE BOOK OF TREES. Lemmon, Robert S. 63 pages, illustrated, part colored, indexed. Garrard Press, Champaign, Ill. 1960. $2.25

Mr. Lemmon writes simply but authoritatively on tree seeds, roots, and leaves and clearly describes the fundamentals of tree growth and physiology. He emphasizes the importance of trees. The illustrations are good.

MEADOWS IN THE SEA. Malkus, Alida S. 72 pages, illustrated, part colored, indexed. World Publishing Co., Cleveland, Ohio. 1960. $2.75

Microscopic animals and plants, living in the underwater world, are accurately illustrated and described. Written for the junior naturalist, this is a fine addition for the nature-study shelf.

PAPER. Meyer, Jerome S. 93 pages, illustrated, indexed. World Publishing Co., New York, N. Y. 1960. $3.50

A dramatic history of paper beginning with the very first papermaker, the wasp. Modern methods are explained in detail and are well illustrated by photographs. According to Mr. Meyer's statistics "a typical American family of four uses approximately 1,700 pounds of paper a year."

PENNY THE MEDICINE MAKER; THE STORY OF PENICILLIN. Epstein, Sherrie S. unpaged, colored illustrations. Medical Books for Children, Minneapolis, Minn. 1960. $2.75

Penicillium notatum, or Penny for short, the good germ, is blown through an open window into Dr. Fleming's lab. In due time there is a battle between Penny's good gang and the bad germs, namely, Strep, Pneumos, and the Staph. An exciting little story of an elementary grade. At the end of the book is a supplementary page for grown-ups, which gives a brief history of the discovery of penicillin.

BOOKLETS

Catalog of Hardy Trees and Shrubs, a list of the woody plants grown outdoors at the Garden in 1942. Illus. Price 75¢ per copy.

Hardy Ferns and Their Culture. Illus. Price 25¢ per copy.

Flora of the Unicorn Tapestries. Illus. Price 25¢ per copy.

Food and Drug Plants of the North American Indians. Price 25¢ per copy.

Montgomery Conifer Collection, non-technical descriptions of conifers with information on history, habitat, and usage. Illus. Price 50¢ per copy.

Plants of the Holy Scriptures. Price 25¢ per copy.

Succulent Plants of New and Old World Deserts. Illus. Price 50¢ per copy.

Vegetables and Fruits for the Home Garden. Price 25¢ per copy.

Also reprints of well-illustrated, step-by-step articles on different garden techniques, written and photographed by T. H. Everett, Assistant Director (Horticulture): "Lawn Verges," "How to Force Dutch Bulbs" (in the home), "Some Sources of Humus," "Tree Pruning Pointers," "Sowing Seeds in Flats," "How to Transplant," "Some Fall Gardening Work" (i.e. heeling in, root cuttings, bulbs in pebbles), "Winter Protection of Plants."

10¢ each — any 6 reprints 50¢

The above booklets and reprints are obtainable from The New York Botanical Garden

THE NEW YORK BOTANICAL GARDEN

BRONX PARK NEW YORK 58, N. Y.

MEMBERSHIP

We were delighted to welcome the following new members between October 1, 1960, and December 31, 1960.

NEW MEMBERS:

Life
Mrs. Armand P. Bartos*
Mrs. Edward S. Crocker

Contributing
Charles Jay Oppenheim III*
Mrs. Taggart Whipple

Garden Club
The City Gardens Club

Husband and Wife
Mr. and Mrs. Lyndon O. Brown
Mr. and Mrs. William J. Dear, Jr.
Dr. and Mrs. Harry K. Fong
Mr. and Mrs. Carl G. Hornwood
Mr. and Mrs. Kalman V. Illyefalui
Mr. and Mrs. Sam Kollar
Mr. and Mrs. John Mayer
Mr. and Mrs. E. C. Mehrof
Dr. and Mrs. George L. McNew
Mr. and Mrs. Arthur Ohringer
Mr. and Mrs. B. F. Parker
Mr. and Mrs. Dan Rodgers
Mr. and Mrs. Henry S. Sayers

Annual
Mrs. Henry Aranow, Jr.
Miss Esther Barag
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Fred L. Caplan
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Mrs. Gerald J. Curtin
Mrs. Geoffrey Davey
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Miss Anne B. Raleigh
J. L. Roberts
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Mrs. Martin D. Stein
Mrs. John C. Swartley
Dr. Terence Lloyd Tyson
Mrs. Marion Viccars
Mrs. Muriel Watsky
Mrs. Blanche Weisman
Mrs. Philip D. Wiedel
Charles R. Wood
Miss Helen Ziegel
*Change in classification

NEWS, NOTES and COMMENTS

Activities of the Director and Staff. Within recent months, Dr. William C. Steere, Director, visited the Museum of Comparative Zoology at Harvard University, Cambridge, Massachusetts, and the Academy of Natural Sciences, Philadelphia, at the request of the National Science Foundation; attended many of the meetings, luncheons, and dinners of the American Association for the Advancement of Science, held in New York City, during which he addressed the National Association of Biological Teachers on "Biological Problems in Alaska." Several other members of the staff also attended the AAAS meetings.

Dr. Steere attended a panel meeting of the Special Facilities Program of the National Science Foundation in Washington, D.C.; a meeting of the Advisory Committee of the Biological Sciences Communications Project at Stanford University; and a meeting of the Steering Committee of the Biological Sciences Curriculum Study Committee at Boulder, Colorado.

Dr. Harold William Rickett, Acting Assistant Director (Botany) and Bibliographer, used the facilities of the Gray Herbarium and Library in Cambridge, Massachusetts, for a week in December. Dr. Rickett lectured at a recent meeting of the Southampton Garden Club held in New York City.

T. H. Everett, Assistant Director (Horticulture) and Curator of Education, was one of the speakers at a luncheon-meeting at the Brooklyn Botanic Garden, called by Dr. George T. Avery, Director, to consider the future objectives of garden and horticultural writers and teachers. Dorothy Ebel Hansell, Editor of *The Garden Journal,* also attended this interesting session.

Dr. P. P. Pirone, Plant Pathologist, gave a talk at the annual dinner-meeting at the Westchester Mens' Garden Club, at New Rochelle, New York, on "What's New in Gardening."

Dr. David J. Rogers left the last week in January for a two-months collecting trip in Brazil. Dr. Rogers will collect specimens of *Manihot esculenta* and related species for systematic investigation under a grant from the National Science Foundation.

Dr. Bassett Maguire, Head Curator and Coordinator of Tropical Research, will speak on "Some Flowering Plants of the South American Tropics" in the Colonial Williamsburg Symposium, Williamsburg, Virginia, on March 23, 1961.

Dr. Arthur Cronquist delivered several lectures at a well-attended seminar of faculty and students of the Department of Botany, University of Michigan, Ann Arbor, and consulted with Dr. W. H. Wagner while there. Dr. Cronquist spent several days in the Gray Herbarium and Library, at Cambridge, Massachusetts, research on the intermountain flora.

Dr. Herman F. Becker, Visiting Research Associate, contributed a paper on "Paleobotanical Records of Solar Changes" in the section on "Polynology, Dendrochronology, and Varve Chronology" in the symposium of the New York Academy of Sciences, New York City, January 25-28, 1961.

Miss Elizabeth Hall, Sarah Gildersleeve Fife Memorial Librarian, gave three lectures on "Fragrance in the Garden"—one in the Downtown Lecture Series, one before the Little Gardens Club in New York City, and one at St. Barnabas Hospital, New York City.

Miss Georgia Manos who has been working as a graduate student in the Research Laboratory under Dr. Richard M. Klein, Alfred H. Caspary Curator, received her doctorate from Fordham University in January, 1961. She prepared her thesis on "The Effects of Growth Substances on Attached and Detached Roots of *Pisium sativum*." Dr. Manos will join the faculty of the College of Osteopathic Physicians and Surgeons in Los Angeles, California, in September 1961 as an instructor in physiology.

Grant to the Garden. The National Science Foundation, through its Support of Scientific Publications, has awarded a substantial grant to The New York Botanical Garden for the preparation and publication of an international plant index by the use of punched cards and data processing machines. Sydney W. Gould, the principal investigator, will carry on much of the work at the Connecticut Agricultural Experiment Station, co-sponsor of this research program.

Citations of Merit to Mrs. Place and Mrs. Clark. The American Scenic and Historic Preservation Society presented Citations of Merit to Mrs. Hermann G. Place and Mrs. Leroy Clark. The presentations were made by A. Hamilton, the Society's President, at the medals award luncheon on January 18, 1961, which Dr. Steere attended. Mrs. Place is a Vice President of The New York Botanical Garden and a member of the Advisory Council. Mrs. Clark is a member of the Advisory Council.

Mr. Hamilton, in presenting the citation to Mrs. Place said: "Mrs. Place has distinguished herself in many fields of public service, including her important work with the Garden Club of America, The New York Botanical Garden, and the National Arboretum.

"This Society, however, desires at this time to honor her for her outstanding contributions to historic preservation, especially through The National Trust for Historic Preservation in the United States. Her service to this cause in her capacities as Trustee, Executive Committee member, and Vice-Chairman of the National Trust has been prodigious. She has brought to this work not only unusual knowledge of historic houses and gardens in America, but also the benefits of extensive travel and observations in Great Britain and Europe. To this knowledge has been added exceptional judgment and leadership with a dedicated devotion of time and resources.

"As a Society created to promote preservation, and as one of the founding members of the National Trust, The American Scenic and Historic Preservation Society honors Mrs. Place

for her great contributions to the public good in this field."

The citation reads: "To Angela Moore Place. For her distinguished accomplishments in the field of conservation through the media of The Garden Club of America, The New York Botanical Garden, and The National Arboretum, and for her stimulating leadership and ardent enthusiasm in the field of Historic Preservation as Trustee, member of the Executive Committee and Vice Chairman of The National Trust for Historic Preservation in the United States."

In presenting the citation to Mrs. Clark, Mr. Hamilton said: "America is fortunate in the interest that her women take in civic, religious, and political affairs. Women have long been leaders in the cause of conservation of natural resources. In their garden clubs and local women's clubs and the national federations with which they are affiliated, they have sponsored their own conservation programs and have supported those of other organizations which have had local or country-wide significance.

"They have been effective champions of national and state park programs, the protection of wildlife and the restoration of historic sites and structures. It is a high privilege to honor one of these leaders today.

"She is a dedicated conservationist, long active in the Garden Club of America. She has served on its Conservation Committee as a specialist in national park affairs. She has been chairman of the Parks Committee. In 1957 she was awarded the Margaret Douglas Medal by the Garden Club of America for notable service to the cause of conservation. She is familiar with nature reservations in foreign lands, having been a member of the Copenhagen Assembly of the International Union for the Conservation of Nature and Natural Resources. For many years, she has been the President of the Palisades Nature Association, and was most influential in the public relations activities that assured New Jersey support for the Palisades Interstate Parkway. Her wise counsel guided the Park Commission in the establishment of the Greenbrook Sanctuary. Her interest has extended to the National Arboretum in the Nation's Capitol.

"Always gracious, always patient, always cooperative, always carrying her full share of responsibility in any project, but always avoiding public applause, this charming lady, Edna Ames Clark, is accorded the admiration and praise of the trustees and membership of The American Scenic and Historic Preservation Society for her leadership and outstanding achievements in the field of resource conservation."

The citation reads: "To Edna Ames Clark. For her lifetime devotion to the field of Conservation and her exemplary accomplishments via active participation in civic, wildlife, and garden organizations, and in particular for her leadership in The Garden Club of America and the Palisades Nature Association."

The Association of Museums of New York State was officially launched on January 13, 1961. Dr. Steere, Director of The New York Botanical Garden, was elected president.

A committee was appointed to survey the needs and functions of museums within the state, and to establish a criterion for the name museum.

Museum Advisory Council. Harold K. Hochschild, a founder of the Adirondack Museum and President of the Adirondack Historical Association, was appointed chairman of the advisory committee by Dr. James E. Allen Jr., State Education Commissioner. The members of this committee include Dr. Steere, Dr. James A. Oliver, Director of the American Museum of Natural History; W. Stephen Thomas, Director of Rochester Museum of Arts and Sciences; J. H. G. Pell, Managing Director of Fort Ticonderoga Association; James J. Rorimer, Director of the Metropolitan Museum of Art; and Rene d'Harnoncourt, Director of the Museum of Modern Art in New York City.

Dr. Hugh M. Flick, Associate Commissioner of Education, and staff members of The New York State Museum and the State Education Department will work with this committee in studying the needs and contributions of museums in New York State and in developing ways to strengthen the museum programs.

The Torrey Botanical Club held a very successful symposium during the meetings of the American Association for the Advancement of Science in New York City last December. About three hundred attended the morning and afternoon sessions at the Hotel Biltmore; and one hundred and fifty-six guests at the luncheon heard Dr. Barry Commonor, of Washington University, St. Louis, Missouri, deliver a stimulating and provocative talk "In Defense of Botany." It was Dr. Commoner's address as retiring president of the Botanical Society of America. Dr. Steere presided at the luncheon in the absence of Dr. Charles Berger, the Club's President.

The annual meeting of the Club, held at the Faculty Club, Columbia University, on January 17, 1961, was well attended. Dr. Clarke T. Rogerson, the Secretary, read the names of one hundred and forty-nine applicants who were accepted for membership, the result of a recent membership drive directed by Dr. Steere, Chairman of the Membership Committee. Dr. Charles Berger, Chairman of the Department of Biology at Fordham University, gave his address as retiring president; his subject was "Cytological Features of Plant Development."

Elected to office were: Dr. William C. Steere, President; Dr. Lindsay S. Olive, Vice President; Dr. Annette Hervey, Corresponding Secretary; Miss Mathilde P. Weingartner, Recording Secretary; Dr. Rita M. McMahon, Treasurer; Dr. James Gunckel, Editor; Howard Swift, Manager of Publications; Dr. Clark T. Rogerson, Bibliographer; Dr. Harold William Rickett, Historian; Dr. Lela V. Barton, member of the Board of Managers of The New York Botanical Garden.

At the meeting on February 7, Carl J. Schiff, Director of Horticulture for the Department of Parks, New York City, discussed "Some Aspects of the Horticultural Activities of the Department of Parks." At the meeting on February 21, Dr. Richard C. Staples, of Boyce Thompson Institute for Plant Research, presented "Some Physiological Comparisons between the Conidia of *Aspergillus niger* and the Uredospores of the Bean Rust Fungus."

The spring program follows: March 7, Dr. Carl L. Withner of Brooklyn College—Brooklyn Botanic Garden, on "Introgression in Cattleya Orchids"; March 21, Ernest Guenther, Vice President and Technical Director of Fritsche Bros. Inc., on "Essential Oils of Africa"; April 18, F. Gordon Foster, of Bell Telephone Laboratories, on "Our Northern Ferns and Their Identifications"; and May 16, Dr. Bassett Maguire, Head Curator and Coordinator of Tropical Research at The New York Botanical Garden, on "Flowering Plants of Guyana."

The Sixteenth International Horticultural Congress will be held in Brussels, Belgium, August 31-September 8, 1962, under the auspices of the International Society for Horticultural Science. The Society, founded in April 1959, took over the activities of the International Committee for Horticultural Congresses.

Sections of the plenary sessions will be devoted to vegetable culture, fruit culture, floriculture, nursery, tropicals and subtropicals. Special group meetings are planned as well as a general assembly and reunions of commissions. There will be excursions to horticultural centers, research institutions, and tourists' attractions.

Those who wish to present a scientific paper are requested to send the exact title and a resume of two hundred words to the Secretary-General, 233 Coupure links, Ghent, Belgium, not later than June 30, 1961. If possible, the resume should be submitted in the three official languages of the Congress—English, French, and German.

The American Iris Society, with the assistance of The New York Botanical Garden, will celebrate the Society's forty-first anniversary at its birthplace on May 26, 1961. The Society was founded on January 29, 1920, at a meeting held at the Garden and arranged by Dr. H. A. Gleason, Dr. John C. Wister, and the late Frank B. Presby. The Presby Memorial Iris Garden in Montclair, New Jersey, is named in his honor.

Dr. Gleason, noted botanist and author of many scientific publications, is Curator Emeritus of The New York Botanical Garden. Dr. Wister is Director of the Arthur Hoyt Scott Horticultural Foundation at Swarthmore, Pennsylvania. They will be honored at special exercises to be held in the Lecture Hall of the Museum and Administration Building on the afternoon of May 26. Mrs. Ethel Anson Peckham, Honorary Curator of the iris and narcissus collections at the Garden, will also be honored on that occasion. Mrs. Peckham took an active part in the first trial garden of the American Iris Society that was started at The New York Botanical Garden in August, 1920.

The Garden's extensive iris borders have been made ready for the visit of hundreds of iris growers from all parts of the United States. The borders, now located on the upper terrace around the Conservatory, extend five hundred feet or more on each side of a wide path. They are filled with more than twenty-five hundred plants representing six hundred and thirty varieties. Many of the plants have been contributed by officers and members of the American Iris Society, by the Arthur Hoyt Scott Horticultural Foundation, and by Cedar Brook Park Iris Garden through Miss Harriette R. Halloway with the approval of the Park Department and the Plainfield Garden Club.

Mr. Everett is a special member of the Committee on Arrangements, representing The New York Botanical Garden. Mrs. Hansell is Vice

Chairman, as is Mrs. F. P. Walther of the Presby Memorial Iris Garden, under Mrs. Kenneth Smith of Dongan Hills, Staten Island, General Chairman. John Gatty, of Fairlawn, New Jersey, Vice President of Region 19 of the American Iris Society, in which the four-day annual meeting will be held, is an advisory member of the Committee on Arrangements as are other regional officers.

The International Rhododendron Conference will be held at the Multnomah Hotel, Portland, Oregon, May 11-14, 1961. Among the talks scheduled on the program are: "Rhododendrons and Azalea Varieties for the West Coast" by P. H. Brydon, Director of Stryberg Arboretum, San Francisco; "Rhododendrons at the Royal Botanic Garden, Edinburgh and Benmore" by Dr. H. A. Fletcher, Regius Keeper of the Royal Botanic Garden, Edinburgh; "Rhododendron and Azalea Trials at Wesley" by Dr. F. P. Knight, Director of the Royal Horticultural Society Gardens; "Rhododendrons and Azaleas in New Zealand" by Dr. J. S. Yeates of Massey Agricultural College, Palmerston, New Zealand; "The Dexter Hybrids Today" by Dr. John C. Wister, Director of the Arthur Hoyt Scott Horticultural Foundation, Swarthmore, Pennsylvania; and "Classification of the Native American Azaleas" by Dr. Henry T. Skinner, U. S. National Arboretum, Washington, D. C.

Dr. Clement G. Bowers of Maine, New York; Joseph B. Gable of Stewartstown, Pennsylvania; Rudolph Henry of Brooks, Oregon; A. M. Shammarello of Euclid, Ohio; and H. L. Larson of Tacoma, Washington, will participate in the symposium on "Breeding Developments in the United States."

The conference program provides for a visit to the National Test Garden of the American Rhododendron Society, located on an island in Crystal Springs Lake in the Eastmoreland section of Portland. The first planting was made in 1950. Today there are about three thousand plants; these include two hundred and twenty-five species and three hundred named varieties. Practically all the series are represented. A quonset-type building with a plastic roof, and electrically heated and ventilated, was erected in 1956 to accommodate tender rhododendrons. The building is also used for the annual show of the Portland Chapter of the American Rhododendron Society.

The Horticultural Society of New York at its annual meeting, held on January 18, 1961, presented special awards to Harold Epstein as "an amateur horticulturist of outstanding ability," to Alfred B. Graf "for outstanding accomplishments and contributions as a professional horticulturist," and to the Worcester County Horticultural Society "for outstanding contribution in extending horticultural interest and education."

Mr. Epstein, a member of The New York Botanical Garden, is a "member of a large number of both foreign and domestic plant and horticultural societies. He is most active in the American Rock Garden Society . . He is past president of the Mens' Garden Club of New York and of the Northeast Chapter of the American Rhododendron Society. He organized the Hortus Club of New York of which he is president, and he is also currently president of the Greater New York Orchid Society.

"Sometimes it is impossible to make a fine distinction between the amateur and the professional horticulturist, for often one invades the field of the other. We find ourselves in this dilemma in properly cataloguing Harold Epstein. Too often the word 'amateur' is applied to the novice or inexperienced, whereas the true definition which fits him stems from the Latin "amator," or lover; that is, one who practices an art not professionally, nor for profit, but for the love of it. No amateur horticulturist has pursued his avocation with more thoroughness, zeal, intelligence, devotion, and resourcefulness than has Mr. Epstein.

"His interest and curiosity led him to specialize and concentrate on ericaeous plants with accent on the dwarfer rhododendrons and azaleas. In addition, he has demonstrated a keen interest in and knowledge of lilies, primulas, ferns, hardy small bulbs, and choice dwarf shrubs, particularly Japanese.

"Today his garden, a miniature arboretum, boasts of being one of the finest private collections of choice and unusual plants. . .

"Alfred Graf has to his credit the collecting and introduction of a large number of tender flowering and foliage plants, which resulted from his numerous trips to practically every tropical and subtropical country of the world. These were obtained from botanical gardens, herbaria, private collections, the market places, and native habitats.

"Another important result of his exploration and knowledge of tender plants is his writing of several books, the most ambitious one being *Exotica*. . ."

"The history of the Worcester County Horticultural Society is both interesting and unique. .

"The success of a fair in 1870 in the old town hall on Worcester Commons, to raise funds for the completion of the Bunker Hill Monument, inspired William Lincoln to hold a purely horticultural show. From an admission price of 12½ cents, a $207.99 profit was realized; at the conclusion of the exhibit, the Horticultural Society had its inception.

"In addition to being an architectural gem, it [Horticultural Hall, built in 1928] is said to be the most beautiful and finest of its kind. Based on a per capita membership, the financial statement indicates that it is also the wealthiest horticultural society in the world. The founders would indeed be proud and overwhelmed with the growth of their original investment 121 years ago. The Society is entirely independent of income from dues, which are only a dollar a year per member.

"Work with children and young people has been an ideal of the Society ever since its inception and the many activities provided for them is one of the most rewarding services. . .

"A most unusual, interesting, and useful activity of the Society is its experimental orchard of old apple varieties. . "

Conference on Palaeo-climates. The New York Academy of Sciences, from January 24-28, 1961, held a conference on "Solar Variations, Climatic Change, and Related Geophysical Problems," with all sessions at the Barbizon Plaza Hotel in New York City. Participating organizations were the Section of Geological Sciences, the Division of Oceanography and Meteorology, and the American Meteorological Society of Boston, Massachusetts. The conference was organized and chaired by Dr. Rhodes W. Fairbridge of Columbia University. With representatives from fifteen states of the Union, and scientists from Australia, Belgium, Canada, England, Germany, Hungary, Italy, Netherlands, Russia, and Venezuela, the gathering assumed a truly international aspect.

Among a score of outstanding papers, several concerned themselves with palaeobotanical and with cultural aspects since the last interglacial and postglacial time. Evidence, partially based on the Carbon^{14} method, corroborates and refines known facts in archaeology and anthropology, and sheds new light on climatic cycles. Faunal evidence in relation to climatic fluctuations was presented through mammalian and invertebrate remains (C. Emiliani, University of

The National Test Garden of the American Rhododendron Society in Portland, Oregon.

Miami; F. E. Zeuner, University of London, England, and others); floral aspects through tree ring studies (D. J. Schove, St. David's College, Kent, England); and palynology (M. B. Davis, P. B. Sears, Yale University). The New York Botanical Garden was represented by the author who presented the taxonomic problem of macro-palaeobotany in establishing palaeoclimates.

Admittedly (M. B. Davis) pollen diagrams as evidence of climatic changes still leave much to be desired, and much more accurate methods of interpretation must be devised before palynology may realistically defend its hypotheses. Macro-palaeobotany, in this respect, has come of age. The paper on "Palaeobotanical Record of Solar Change" (author) was enthusiastically received, caused many favorable comments about validity in relation to climate determination, and is acknowledged to present one of the irrefutable, direct evidences based primarily on ecological comparisons with living plant associations. All fossil assemblages in the world contribute partially to the interpretation of climatological events. An exacting inference begins with the appearance of angiosperms in the late Cretaceous and becomes more accurate, even irrevocable, during the sequence of Tertiary epochs. Palaeobotanical structures of the Tertiary assume a progressively modern aspect expressed in morphological structures of leaves, flowers, bracts, fruits, and seeds which mirror taxonomically existing floras that are adapted to a specific climatic environment. Through fossil taxonomy a further accurate interpretation of evolution, migration, topography, precipitation, and climate, as a whole, is possible. A fossil flora which is generally analogous to a comparable living association is expected to have lived under similar climatic conditions. All Teritiary floras fit into this pattern, of which the Lower Eocene Ruby Mormon Creek Flora and the Upper Oligocene Ruby Passamari Flora (paper shales), recently studied at The New York Botanical Garden, are examples of two contrasting floristic and climatic epochs.

At the concluding informal dinner in the New York Academy of Sciences building, Dr. Allen T. Waterman of The National Science Foundation spoke on the achievements of meteorologists during the post-war years, and also warned of the potential dangers to humanity inherent in the unscrupulous application of scientific information which may well outpace its reasonable management and use by man. "What a calamity to the world it would be if, somehow, the roof of the Academy building would fall in and all the leading proponents in this field of meteorology, here assembled, were no more."

Abstracts of all the papers were printed in time for the conference, and complete papers will be published within six months or as one volume of the *Annals of The New York Academy of Sciences*. This work will supplement an earlier volume as a standard text in meteorology and allied subjects for several years to come.

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Spring Garden Tour to historic Bucks County on May 10, 1961, will include the Washington Park Memorial Building, the Thompson Neely House (1702), the Bird Banding Station, and the Wildflower Preserve on Bowman's Hill. In New Hope, Pennsylvania, the group will see Lenteboden Gardens with its beautiful display of more than eleven hundred separate plantings of tulips and other bulbs; the Miller Gardens, noted for its early blooming rhododendrons; the Beaumont House and Gardens built around 1800; the F. T. McClintock Residence and Gardens; and Mechanic Street where the houses date back to 1743.

Lunch will be served at the River's Edge Restaurant on the Delaware River in Lambertville, New Jersey.

This all-day tour is sponsored by The Volunteer Associates of The New York Botanical Garden. The buses will leave at 8:15 A.M. from 22 East 60th Street, New York City. The all-inclusive ticket covers transportation, tour of the houses and gardens, and lunch: price for members of The Garden, $10.50; for non-members $12.50. Send for tickets to The New York Botanical Garden, 22 East 60th Street, New York 22, New York.

Staff Seminars. Dr. Robert F. Thorne, Professor of Botany at the University of Iowa, who had just returned from an extensive study of the native vegetation of Australia, New Zealand, New Guinea, and the Malayan Archipelago, addressed the staff seminar on January 19, 1961. On February 23, 1961, Miss Lorna Maitland of London, England, talked about "Wild Flowers of Down Under." On March 23, 1961, Dr. Steere, Director, will address the staff on "Botanical Activities in Argentina."

Gilbert H. Montague died at his home in New York City on February 4, 1961, at the age of eighty. Mr. Montague had been a member of the Corporation and of the Board of Managers of The New York Botanical Garden since May 1952.

He was one of the country's authorities on antitrust law and was called upon by members of the United States Senate and of the House of Representatives for opinions for the public good. In 1953 Mr. Montague was appointed a member of the Attorney General's Committee to Study Antitrust Law by Herbert Brownell Jr., then the United States Attorney General. Much of the work on the Committee's report was done by Mr. Montague.

He was a collector of rare and valuable manuscripts; among them a fourteenth-century manuscript of the Magna Charta, which he presented to the Law Library of Harvard University; the works of Hugo von Hofmannstahl, which he gave to the Houghton Library; and the works of Emily Dickinson, a collateral relative.

His beautiful estate "Beaulieu" at Seal Harbor, Maine, was visited by many amateur and professional gardeners before it was destroyed by fire in 1956.

Jacques Cattell, editor and publisher of the directory, *American Men of Science,* died on December 25, 1960, at the age of fifty-six in Phoenix, Arizona. His father, the late Dr. James McKeen Cattell, Professor of Psychology at Columbia University, founded *American Men of Science* in 1906.

Mr. Cattell had also been publisher of *American Naturalist* and editor of another directory, *Readers in Education.* He was at one time editor of *Science,* editor of the *Biographical Directory of American Scholars,* and president of Science Press Publishing Co., of Lancaster, Pennsylvania.

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THE GARDEN JOURNAL

THE NEW YORK BOTANICAL GARDEN

DOROTHY EBEL HANSELL
Editor

This issue is dedicated to good gardeners everywhere, but especially to iris growers whose organization, the American Iris Society, began at The New York Botanical Garden on January 29, 1920, and who will celebrate this event during their visit to the Garden on May 26, 1961.

CALENDAR

May 15, 1961. Annual Meeting of The New York Botanical Garden.

May 16, 1961. Torrey Botanical Club meeting at The New York Botanical Club.

May 18, 1961, 11 a.m.-6 p.m. House and Garden Tour for benefit of the Patients Special Project Fund of the Institute of Physical Medicine and Rehabilitation of New York University Medical Center. For information, call Or. 9-3200, Ext. 83.

May 25-29, 1961. Annual Meeting of the American Iris Society: headquarters, Robert Treat Hotel, Newark, N. J.

May 26, 1961, 3 p.m. American Iris Society visits The New York Botanical Garden and celebrates its founding at the Garden forty-one years ago.

June 13, 1961. Nineteenth Annual Rose Day at The New York Botanical Garden.

September 5-9, 1961. Garden Holiday at Lake Mohonk House, Mohonk Lake, New York.

October 25-27, 1961. Sixteenth Annual American Horticultural Congress, Northampton, Mass.

April 27-May 7, 1962. Floralies, International Horticultural Exposition under auspices of Société d' Horticulture and Jardin Populaires de France in Valenciennes, France.

August 31-September 8, 1962. Sixteenth International Horticultural Congress, Brussels, Belgium.

April 26-October 1, 1963. International Horticultural Exposition, Hamburg, West Germany.

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CREDITS FOR ILLUSTRATIONS

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BEARDED IRISES IN THE MIDDLE HEIGHT

By Bee Warburton

Mrs. F. W. Warburton of Westboro, Massachusetts, is one of the founders of the Median Iris Society—the Median Section of the American Iris Society. She served as secretary for five years and is now serving as president.

The American Iris Society classifies the entire range of the bearded irises in six groups, primarily according to their garden uses but also taking into account the interests of iris specialists in developing and promoting certain types. The middle-height range, between the dwarfs under ten inches and the magnificent varieties over twenty-eight inches tall, was divided into four distinct classes. These are the median irises.

This division takes into practical account the vast activity in amateur plant breeding during the present century, by which the genus *Iris,* and particularly its bearded section, has been especially blessed. When this latest classification was set up by the American Iris Society, the tall bearded irises, the best-known to all, had been improved to astonishing qualities; and the dwarf irises, familiar in their early yellows and purples, had been improved to an array of colors and forms still unsuspected by most gardeners. But the irises in between, now classed as the medians, had been sadly neglected.

In the 1950s the trend to smaller plants and flowers suited to post-war architecture, provided the impetus for the production of irises in the wanted middle heights. The tall bearded irises needed for parent stocks in this work had been bred to tetraploid concentrations of genes for coveted traits, and clones derived from species collected for the purpose held promise of future recombinations.

Initial successes from incorporating variants of species into present breeding stocks naturally led to a quickening of interest in the importation of new species from the wilds. Many of these species were collected or obtained from other collectors and sent to this country by Rudolf Hanselmayer of Austria. In 1954, Dr. L. F. Randolph, then head of the Scientific Committee of the American Iris Society and now its President, spent some months collecting in Europe and the Near East and brought back a number of variants of known species. On another trip, in 1959, after spending some months in India, he returned to America by way of the Near East, Russia, and Europe with another large collection of clones of wild species, some of them quite new to this country. This material is made available to hybridizers as fast as it can be tested for adaptability and increased for distribution. In the meantime, cytologists in Dr. Randolph's department at Cornell University are working on the relationships of these various bearded irises, and we have learned much that has been helpful in simplifying some of the problems of interbreeding irises of different chromosome counts and groupings.

The American Iris Society has listed the bearded species separately under each of the six classes of bearded irises; the species listed as miniature dwarfs, besides being among the best of rock garden or wild garden plants, are perhaps the most important in breeding median irises. Foremost among these for both purposes is *Iris pumila*—and here it should be noted that the use of the term "pumila" for all dwarf irises is deplorable. *Iris pumila* is a specific name bestowed by Linnaeus.

The first plants of *Iris pumila* used by hybridizers were color variants raised some twenty years ago from Russian seed by Robert Schreiner of Schreiners' Gardens, and a strain developed from these and some Austrian forms by Paul Cook of Indiana. The original Schreiner forms were 'Nana', 'Sulina', and 'Carpathia', and they are still of importance to hybridizers, as is another form collected on Crete and named 'Cretica'.

Iris pumila is tiny, within its limits extremely variable, and in hybrid combinations has an explosive capacity for many traits. Its great diversity of forms and colors endears it to hybridizers—even if they find it difficult to place their feet between adjacent plants, while they pluck the tiny stamens ripe with pollen. There seem to be three basic color variants of this species, the yellow, the red-violet or purple, and the blue or blue-violet, and these also produce charming personalities in form and pattern. It is a most remarkable species—a whole book could be written about it.

The miniature dwarfs include the diploid species *Iris attica* and *I. pseudo-pumila,* which are of importance for cytological studies, but are of minor value to hybridizers in comparison with the tetraploid *Iris pumila.*

The *I. mellita* and *I. reichenbachii* complex is important in modern hybridizing because of a valued new pattern derived from its germ plasm; this is the dominant pattern of white stands and blue falls. It is useful because all such bicolor patterns have heretofore been recessive in inheritance and hard to manage. This work was initiated by Paul Cook of Indiana, who has carried the effects of this pattern into advanced generations. 'Whole Cloth', one of the irises in *Life Magazine's* 1960 feature on irises, is from such breeding. 'Whole Cloth' is a lovely iris; the next generation from it—and still in the seedling bed—is indeed strikingly beautiful.

Variants and relatives of *Iris aphylla,* classed as standard dwarfs, are of intense interest to hybridizers who look for unsuspected patterns yet to come from them, in addition to what is already considered as derivative: branching, blue beards, and perhaps the accumulative modifiers that make black irises black. They are not the most prepossessing plants, being usually of poor form and with a very peculiar type of branching which gives them a bundled-up appearance. Their stems often fork directly from the rhizome,

and each stem rebranches, with all flowers on extremely slender stalks shorter than the foliage. This is not a handsome type of branching in larger hybrids; and yet, in subsequent combinations, selections may be made of desirable stalks with greatly increased numbers of buds. Hybridizers must know what they are about, when dealing with the species.

The *I. chamaeiris* complex, with members in both dwarf classes, is the most familiar of these bearded species groups, for to it belong the familiar purple and yellow "dwarf irises" of the past. The group is of some importance to the development of new median irises chiefly because it has by nature the same chromosome count and grouping as the new hybrids from intercrosses of tall bearded irises and forms of *I. pumila,* and is interfertile with the new hybrids. In spite of this, few improved varieties are available. Because as a group it is difficult to improve, it is being bypassed in present breeding plans. Included are *Iris chamaeiris, I. italica,* and *I. olbiensis* (the last two are larger than the first), mostly from Italy and the south of France and in cultivation for centuries.

The "flags" so prevalent in our South are relics of another truly ancient group widely distributed and even naturalized in many parts of the world. Such irises are the white *I. albicans,* which was carried about by the Moslems for a grave decoration, the bright red-purple *I. kochii, I. florentina* of commercial orris-root fame, and *I. germanica,* whose name serves as a misnomer for the entire tall bearded group. These play little part in modern hybridizing.

Our nineteenth-century predecessors in iris breeding struggled long and hard to get size into the offspring of the diploid species. The pallidas and variegatas which furnished most of their parent stocks are variable, and some of their forms are really small, about ten inches tall. Today's hybridizers make use of this inescapable dwarf heredity in the older named garden diploids, along with other newly collected diploid forms of wild species in attempting to create new table irises. We have a number of new forms of *Iris pallida* and *I. variegata* themselves, besides additional forms of *Iris cengialtii, I. perrieri, I. rudskyi,* and *I. reginae,* all classified under miniature tall bearded or table iris. So far hybridizers have failed to hit upon the right formula for producing these charming smaller plants for the tall bearded season, and this has surprisingly proved to be a most challenging problem in plant breeding.

I may have given the impression that median iris hybridizers are graduates in botany or related subjects. Nothing could be further from the truth. Breeders operate in any way suited to their own circumstances—from growing a few bee-set seed, or crossing any two pretty irises regardless of their germ-plasm, to the most skillfully planned project of a professional plantsman. Any of these approaches is just as likely as any other to give an individual plant worthy of being named and introduced; garden-worthy varieties are registered with the American Iris Society each year with a record only of the seed parent, or of neither parent.

The new classification of the American Iris Society was an attempt to bring order to the chaos of new hybrid types in all the sizes and seasons of iris bloom, and it has proved, in most respects, extremely successful. It was designed to give encouragement to breeders in working for favored types and to give direction to the Society's system of judging and awards. It also furnishes a sound basis for catalog listings and simplifies the buying of irises for garden uses.

Let us take a look at each of the four median classes. The definitions quoted were prepared for the plaques in the Presby Memorial Iris Gardens at Montclair, New Jersey, under the direction of Mrs. F. P. Walther.

The Standard Dwarfs

"The standard dwarfs are species and garden varieties from ten to fifteen inches in height, of varied characteristics and including all varieties of tall and dwarf parentage that have the height limits of this class. They generally bloom in the late dwarf season."

The American Iris Society classification adds that the stems may be branched or unbranched, "flowers three to four inches across, the leaves often as tall as the flowers, and not falcate. The class includes species and cultivars with chiefly forty or forty-eight chromosomes, including chamaeiris-type clones, the aphyllas," and hybrids of tall bearded irises with *Iris pumila.*

The majority of introductions in this class have been of the so-called Lilliput type, that is first generation hybrids of tall bearded irises with *I. pumila.* The first of these to be marketed in quantity in the early 1950s were labeled "Lilliput Hybrids" by Geddes Douglas, and the name stuck.

These are fine irises. With the introductions of Paul Cook, they have remained as standards and as the basis for any collection for nearly a decade. They also inspired a number of workers to make similar crosses and to try out various other combinations of species with all sizes of bearded irises. "Advanced generation hybrids" (F_2 or later) of complicated breeding are now becoming the rule. Every year adds to the selection of improved varieties in this useful group. In 1959 the American Iris Society established an award for the annual best of this class, to be called the Cook-Douglas Award in honor of the two men responsible for the first introductions in the class. The 1959 award was voted to 'Green Spot' and the 1960 award to 'Tinkerbell'.

Judging standards (the standards by which awards are given and by which hybridizers select from their seedling patches) for the class detail primarily a cushion type of plant, of happy growth and increase, with flowers held just over the foliage. Ideally, a sufficient number of flowers should be produced on the plant to make a good color splash; yet they should be well spaced to show the individual flower form, since the iris is primarily an architectural flower and its form is important even on the smaller and more intimate plants. These are charming flowers, ideally of flaring form with wide petals and ruffling, immensely variable in color and pattern combinations, far superior to anything previously available in their size and season. They may be white, yellow, orange, green, pink, or in various shades of violet, blue, or purple, or combinations of these. They have enormous matching or contrasting beards, they are fragrant, some are adorned with lace or velvet, and they may bloom at unusual seasons.

Some of the best varieties in the color classes are:

Pure white. 'Lilli-white', 'Easter Bunny'.
White, green markings. 'Green Spot', 'Snow Elf'.
White, blue markings. 'How Now'.
Creamy white. 'Brite'.
Yellow selfs. 'Baria', 'Brassie', 'Golden Fair', 'Pigmy Gold', 'Lilli-yellow'.
Yellow with fall coloring. 'Lilli-var', 'Coreop', 'Dancing Bee'.
Blue selfs. 'Small Wonder', 'Blue Denim', 'Fairy Flax'.
Blue with deeper blue markings. 'Jersey Lilli', 'Tinkerbell'.
Red-purples. 'Garnet Treasure', 'Red-Lilli', 'Pagan Midget'.
Dark violet. 'Little Shadow'.
Pastel blends. 'Spring Mist', gray-lavender; 'Tolita', 'Pastel Gem', blue and chartreuse; 'Truce', green-yellow; 'Lilli-green', greenish bicolor.
Plicatas (stitched edges) on white. 'Dale Dennis', 'Little Dogie'; on yellow, 'Wee Reggie'.
Pink. 'Lillipinkput'.

Intermediate Bearded

"The intermediates are hybrids of dwarf and tall bearded parentage, or advanced generations thereof, from fifteen to twenty-eight inches in height, with erect branched stems usually taller than the leaves. They bloom between the standard dwarf and the tall bearded seasons." In the New York area this would be around May 15.

The Hans and Jacob Sass Award, initiated in 1960 as an annual award for the best in this class, was given to Paul Cook's 'Kiss-Me-Kate'. This was an intermediate of a somewhat different breeding from the usual for these irises, but it was of the hybrid origin which is their norm; their earliness of bloom comes from a dwarf ancestor.

Their garden-value depends upon this earliness; most of the old-timers were hopelessly outclassed, if they ran over into the tall bearded season. Because of a sterility barrier it was formerly difficult to improve them by breeding among themselves, and this is still true; but it is now possible to create very handsome intermediate plants in the first generation of crosses between the highly developed modern tall bearded and the newer standard dwarfs. When good crosses of this sort have been outlined for the various color classes, it is unlikely that many breeders will try to improve them by intercrosses. A more productive type of breeding appears to be backcrossing them with their tall bearded parents, a type of crossing which may be productive of future surprises.

Few intermediates from the new standard dwarfs are yet on the market, but there will soon be improved pinks, blends of various types, plicatas, and self-colorings in blue, yellow, purple, and "red."

The symposium of the Median Iris Society for 1960 showed among the ten best the billowy white 'Cloud Fluff' and its sister 'Blue Asterisk', blue with a deeper pattern in the falls; 'First Lilac', a delightful pale lilac-pink; the bright red-purple 'Florinda'; the prize-winning 'Kiss-Me-Kate', cream with a blue edging on its falls; and 'Pink Debut', first of the tangerine bearded pinks, a break not too perfect in form or clarity of color.

Many of the older intermediates are widely known and grown, but they are usually purple, yellow, or white. Among them are 'Black Hawk', 'Black Magic', 'Ruby Glow', and 'Red Orchid' in the purples; 'Southland' and 'Sangreal' in yellows; 'Ultra', perhaps as blue as any iris; and *albicans*, 'Autumn Queen', and 'Zua' in white. The latter, with crinkled petals, is very popular.

Border Bearded

"The border irises are diploids or tetraploids from fifteen to twenty-eight inches in height, with stiffly erect branched stems and of larger proportions than the miniature tall bearded irises. They bloom with the tall beardeds of which they are the shorter varieties."

The American Iris Society's award for the best border iris of the year was named for Harold Knowlton, a past president of the Society and one of the first to recognize the value of the smaller irises. The Knowlton Award was given for the first time in 1960 and went to 'Yellow Dresden' developed in Utah by Margaret Allbright.

The border irises are not quite so simple a problem as they seem, for although the class includes all tall bearded with shorter stems regardless of flower size, many specialists prefer plants in which the flowers and stems are in proportion. Nonetheless, many gardeners are fond of big flowers whatever the stem length, so the big "shorties" have found their place. So far most of the border irises have been "accidents" in breeding for tall beardeds, but there is now more interest in breeding them with intent.

Some of the older ones are still desirable, and it is unlikely that the best of the old diploid irises will ever fade completely from gardens no matter how they are classed. For one thing, they have a nostalgic charm; for another, they are among the toughest and most persistent of garden perennials. 'Pink Ruffles', a very fine garden and landscape plant, still hovers at the top of lists of choice border irises. It was developed by Kenneth Smith of Staten Island, the well-known hybridizer of honored tall beardeds, and he has been heard to mutter that he is doomed to be remembered for 'Pink Ruffles'. In the familiar yellow and red, 'Gay Hussar' is a favorite with many even in this modern age.

Some of the older tetraploid varieties that are registered as tall beardeds are actually border irises. One of the best

of these is 'Black Forest' which rates high among all irises. 'Buttonhole' is a very charming small yellow iris; 'Paradise Pink', one of the earlier pinks, is widely used for hybridizing as well as being a fine garden plant. And there is still no whiter white than 'Priscilla'.

It is hard to keep pace with the output of new border irises in all the bright new colors and fashionable breaks of the tall bearded. Some that have proved themselves in the Median Iris Society's test gardens are 'Frenchi', a bright rose bitone; 'Chocoleto', a dark brown of fine growth habit at the upper height range of the class; 'Donna D', a flaring broad-petaled white with rather large flowers for its height; 'Yellow Dresden', the lacy yellow that won the first Knowlton award, and its sister, the pink 'Yum-Yum'. Pinks abound in the class because the tall bearded pinks carry factors for shortness: 'Little Gem', 'Border Pink', 'Pink Pixie', and 'Wee Bit' are good. Mildred Brizendine's 'Little Reb' and Cassebeer's 'Sputnik' are both excellent plicatas. 'Primrose Bonnet' is a charming soft yellow, and 'Little Brother' is a browner edition of 'Garnet Royal'.

Miniature Tall Bearded

"The miniature tall bearded or table irises are the smaller diploid tall bearded irises from fifteen to eighteen inches in height with slender flexuous stems and flowers not over three inches in width. They usually bloom with the tall bearded irises."

Hybridizers have not yet succeeded in producing enough new varieties true to the type to warrant a special award by the American Iris Society. They have not found a formula for breeding plants to the exacting specifications set up for the table irises. So far the plants have been smaller editions of the old-fashioned diploid tall bearded irises and have shown none of the modern tall bearded breaks. It might be questioned whether flowers with some of the special features of the modern tall beardeds, such as great width of petal and extreme ruffling or laciness, would be suitable for this class, for which daintiness is a primary requirement.

These flowers were originally selected for arrangements, and here subtleties of color or contrast are more important. However, they are very fine plants, with grace of line and size scaled to small gardens, and they bloom with the tall bearded. They are sometimes grown in the forefront of plantings of tall beardeds, but the competition they present is that of a sixth-grader in a "Miss America" contest.

Actually, the most recent introductions in this class look no more modern than the originally selected group on which the type was based. 'Parakeet' and 'Smarty Pants', for instance, have the same yellow stands and red-lined falls as the species *Iris variegata*. 'Desert Quail' is a neat small plicata, but so is the original 'Widget'. The older ones show some variation—'Nambe' and 'Spring Sprite' have violet-blue in their falls with yellow stands. 'Two for Tea' is a pale orchid; 'Daystar' is a dainty variety with bright reddish beard and almost the airiness of the vesper iris; 'Chewink', 'Tid Bit', and 'Tom Tit' are blues of various depths.

I have not touched on the culture of median irises, for it is the same as for all bearded irises.

Five new Japanese iris of the Marhigo Strain: 'Driven Snow', fully double, white; 'Galatea', flax-blue, sharply penciled white; 'Royal Crown', red and white bicolor with crested white center; 'King's Court', large, beet-red with white veining; 'Veiled Vanity', ruffled white with blue veining.

TODAY'S JAPANESE IRIS

Recent and continuing strides in the development of Japanese iris are making this spectacular perennial one of the most desirable plants for the modern garden. Improvements have been especially notable in the semi-double and double types. Many of the latest originations, because of their curious concentration of petalodes in the flower's center, resemble peonies in form. Others with extreme ruffling and fluting have been likened to large-flowered azaleas.

Branching, once a problem, has now become a rather common trait of the newer sorts. Most of them have two- or three-way branching as a result of hybridizing of well-branched parents. Likewise, a greater clarity of color has been achieved through careful selection of parent varieties and the seedlings that emerge.

Consistent hybridizing and line breeding of American hybrids have yielded a remarkable array of superior colors, forms, and types for the Japanese iris fancier, who may be unaware of the shortcomings of the original strains imported from Japan. Even now, there are colors that elude Japanese iris hybridizers—yellow, orange, and greenish shades. Perhaps "breaks" in these colors are not too distant, if the present rate of progress is maintained.

American hybridizers widely recognized as leading contributors to contemporary Japanese iris are Walter Marx of Boring, Oregon, and W. A. Payne of Terre Haute, Indiana.

Walter Marx, developer of the Marhigo Strain of Japanese iris, has succeeded admirably in his endeavor to create general standards of nomenclature for Japanese and other iris now available. The Marhigo Strain is registered in compliance with the American Iris Society's program to assure the accuracy and non-duplication of iris names. The early registrations were limited yearly to ten varieties of any one grower's originations in all iris classifications, but this limit was raised in 1959 to forty, permitting a large backlog of varieties to be registered.

Fourteen new registered Marhigo iris are being introduced for 1961 by Walter Marx Gardens. Each is a distinct advance in its color class, and Mr. Marx believes that some will set the standard for a number of years.

A most careful selection and crossing program has also been pursued by Mr. Payne, who rigidly sets his standards for introductions from a reported annual seedling crop of about eight thousand.

New seedlings are produced, as with the different types of bearded iris, by cross-pollination and planting of seeds from hand-pollinated blooms.

Proper culture is particularly important and rewarding in growing Japanese iris. They require an acid soil similar to that for azaleas and rhododendrons. Lime is harmful; if present in the soil, the leaves will begin to turn yellow, indicating that the plants should be moved to another location.

To counteract alkalinity, one may add sulphate of ammonia, peat moss, or oak leafmold. It is also beneficial to prepare the soil with any well-rotted manure or acid-base commercial fertilizer. The crowns should be set about two inches below the ground level in planting. Moderate moisture is sufficient until the blooming period approaches, when these irises require abundant moisture. While they are blooming, it is almost impossible to supply too much water, provided the soil has normally good drainage.

First-year flowers are seldom of true quality; usually a full year is required for the plants to become well enough established to produce any blooms at all. Propagation is by division of the root clump. O.A.R.

SOIL FERTILITY — A CORNERSTONE OF SUCCESSFUL GARDENING

By F. J. KNOCKE

Dr. Knocke pursues his hobby of gardening whenever his duties as orthopedic surgeon and Assistant Medical Director of the Hunterdon Medical Center in New Jersey permit him to do so. He has been interested in dahlias for thirty-two years—knew the late Dr. Marshall Howe of The New York Botanical Garden and compared notes on dahlias with him. Within recent years Dr. Knocke has developed a lively interest in iris. Members of the American Iris Society will visit his garden during the four-day annual meeting to be held in Region 19, May 25-29, 1961.

FEW GARDENERS are fortunate enough to belong to a family whose two hobbies supplement each other as well as ours do. My wife and daughters ride horses, and I grow flowers, especially irises and dahlias.

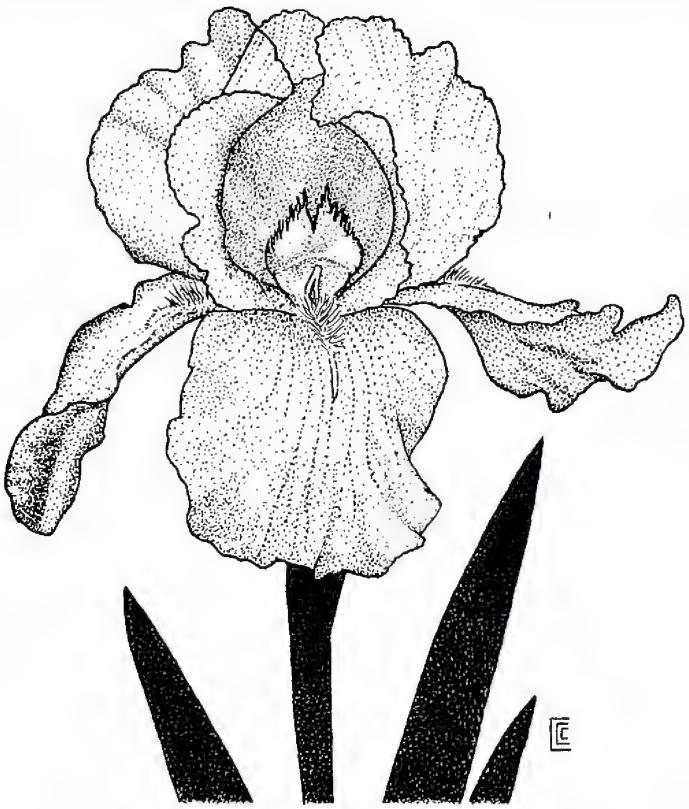
Seven years ago we moved from the Bronx, New York City, where for twenty-five years I grew dahlias for show in a small back yard, to an eighty-acre farm in the rolling hills of Hunterdon County in western New Jersey. Here our hobbies are primarily limited by time—not by space as previously.

Six horses contribute to the fertility of the acre that is used for horticultural purposes. In keeping with the practices of the neighboring dairy farmers, the manure is spread directly on the fields in winter and plowed in when the ground becomes workable in the spring. Because of heavy application, up to six inches deep, the straw tends to clog the plow, so the area is rototilled first, and then plowed. During the summer the manure is composted, along with all organic garden wastes, and this material is then turned in the following fall or spring.

The result of this heavy application of organic material has been to increase the friability of the shale soil, and to increase the depth of the topsoil on the solid shale base. The soil now adsorbs water more quickly and holds it longer, but it does not get muddy and can be cultivated sooner after heavy rain or watering. In appearance it is darker in color—it looks "fertile."

All available organic material is incorporated in the soil, the more the better. In addition, chemical fertilizers are used in concentrated applications. For the dahlias and gladiolus, up to two tons of 5-10-10 fertilizer per acre are incorporated with a rototiller in four or five applications through the growing season. Extra phosphate is also used during early growth. This is applied as superphosphate or bonemeal, two or three hundred pounds per acre. Just before the blooming period extra nitrate is added, usually in the form of calcium nitrate solution (fifty pounds of the chemical per acre). To increase root production extra potash may be added, usually wood ashes from the fireplace. The organic material in the soil adsorbs these fertilizers and releases them slowly. It acts as a sponge or buffer.

The chemical fertilizers are applied not only to provide nutrients directly to the plants, but to "feed the soil," that is to feed the microorganisms that are composting the organic material in the soil. As a result of microorganic activities, the chemical fertilizers are "bound" and then



released gradually, so that they are continuously available to the plants.

This program has resulted in vigorous plant growth and fine flowers. However, a few words of caution are indicated. Too high an application of nitrogen produces extra-sized flowers which are soft and do not last so well as those that are not forced. The roots of plants so forced are also soft and do not keep well in storage or winter well in the ground. Moreover, heavy applications of chemical fertilizers must be watered well to render them soluble so that they can be used by plants and microorganisms. When chemical fertilizers are applied on top of fertilizers not yet dissolved, tender roots are burned and plants wilt.

The program that has been outlined of using organic material in the soil is a general one. It must be varied to meet the needs of different plants.

Dahlias, irises, gladiolus, and peonies are the plants that I grow. They all have fleshy roots, so I am careful that the manure is well composted before it comes in contact with the roots. This is especially important for the irises and peonies. No fresh manure is added to the soil in which they are to be grown for six months or a year before planting. Water and fertilizer are withheld from the iris for two months after they have bloomed—during the dormant or resting phase.

There are, of course, certain disadvantages in using manure. One is that the composting, spreading, and mechanical dispersion and incorporation in the soil are heavy work and take time and expensive equipment if done on a large scale. Weed seeds are spread, and additional cultivating is required. If the manure is not well composted before it comes in contact with roots, it increases the possibility of the development of rot. And then there is the odor; in a small area this can be overcome by covering the compost heap with soil. If a free source is not available nearby, manure may be expensive to purchase and transport.

In spite of these disadvantages, and if the gardener is willing to expend the time, work, and money to overcome them, soil fertility can be improved and maintained by the liberal use of manure. I for one think it is well worth the effort.

With the addition of organic compost (manure when available) the fertility and productivity of our plot in New York City increased each year. When the time came to sell the property, the purchaser confided after the sale that it was the wonderful soil in the garden more than any other one factor that influenced her to buy the house.

Soil fertility is the cornerstone of successful gardening. Pedigreed stock and skillful care after planting are wasted if the seeds "fell on stony ground." Personally I derive much pleasure from improving the soil in my garden. Preparation before planting, cultivating, watering, and fertilizing, all are easier to do and more effectively accomplished with a granular, porous yet retentive, fertile soil. I enjoy growing flowers, displaying them in the garden, giving them to friends, exhibiting them at flower shows, but I also enjoy working with the soil in the garden, and I derive much satisfaction in seeing it improve from year to year.

NOTEWORTHY HERBACEOUS PERENNIALS

By ANDRE VIETTE

Mr. Viette, a horticulturist, is Manager of the Martin Viette Nurseries at East Norwich, Long Island, lecturer, and writer on perennials in which he is especially interested.

MANY NOTEWORTHY hardy perennial plants are adaptable to a wide range of soils, are relatively free from insect pests and diseases, and require little care. A perennial plant must be able to flourish in different soils—sandy, loamey, or clayey—varied in organic content and structure to be a useful plant for the gardening public. It must have the stamina to thrive for many years after the initial soil preparation and planting have been completed. It must be able to survive the rigors of a hot dry summer and a fluctuating winter. Perennials that have few insect and disease problems are in demand, because today's suburbanites do not relish a weekly spray ritual; they prefer to use their leisure to enjoy their gardens.

Artemisia albula 'Silver Queen' has wider leaves and a bushier habit but is similar in other respects to *A. albula* 'Silver King'. Its cream-colored racemes are not showy; 'Silver Queen' is used mainly for its beautiful gray foliage. This plant is relatively free from insects and diseases. It

Lamium galeodolon variegatum

grows four feet high. It thrives in full sun and tolerates sandy as well as clayey soils. Propagation is by division in early spring or early fall or by terminal cuttings taken in June.

Heliopsis scabra is a fine summer-flowering perennial and lasts long as a cut flower. It should be grown in full sun, as it elongates excessively and becomes straggly in light shade. *H. scabra incomparabilis* has brilliant golden semi-double flowers and grows to a height of thirty-eight inches. It has one of the longest flowering periods of any perennial, commencing June 15 and continuing until October. 'Gold Feathers' and 'Goldranunkel' are two improved cultivars which will find an important place in the gardens of America. Some pathogens and insects have been reported to attack *H. scabra* in this country and Europe; but aphis, which infest the terminal growing portion of the plant, are the only pests that may necessitate spraying. Division in early spring or early fall or tip cuttings taken in late May are the means of increasing stock of a particular cultivar. Although heliopsis grows well in varied soils, it does best in a rich, well-drained loam.

The hemerocallis or day-lily is considered to be the perfect perennial, as it will grow in sun or shade, wet or dry situations, heavy or light soil, and requires little care. It is long-lived and relatively free from insect pests and diseases. Some years thrips bother buds and flowers.

As most hemerocallis cultivars meet the requirements for garden-worthy perennials, I can be critical in evaluating and selecting the best. 'Star Dream' ('Vespers' × 'Bountiful' —P. J. Tass) in this area has excellent branching. It blooms for a long period (July 15-August 10) with many flowers opening each day. All the flowers are displayed individually without being crowded. Its sturdy stems withstand wind and rain. 'Star Dream' has proved durable under adverse weather—even during spells of excessive heat, the petals retain their substance and brilliant pigmentation. This pale yellow, very fragrant hemerocallis opens at five o'clock in the morning and lasts well into the evening. It increases rapidly in size, is easily propagated, and has few insect pests and diseases. Although it does not have the largest flower and its form is not the most perfect of the cultivars, I consider 'Star Dream' one of the best of the new introductions because of its prolific blooming and durable growing habits.

One of the finest groundcovers that has come to my attention is *Lamium galeodolon variegatum.* It is not a well-known plant. Its extremely rampant growth lends itself well to use on steep inclines and large areas in need of covering. Because of its rapid spreading habit, it should be confined in the garden by metal edging and should not be planted where it will encroach on other perennials. *L. galeodolon variegatum* is one of the few plants that has true silver markings rather than the usual yellow and white. It carries short heavy racemes of pale yellow during June. It grows in full sun as well as light shade, flourishes in soil rich in organic matter, and is propagated by division, runners, or vegetative cuttings taken in July.

Lysimachia clethroides spreads vigorously and should be given plenty of space. It is especially adapted to naturalistic planting. *L. clethroides* grows thirty inches high, is tipped with four-to-six-inch curved spikes of white florets from the first of June to the first of August. It is a very good cut flower and has lasted for two weeks in an outdoor display in the shade. It grows well in any soil, even tolerating an excessively wet location, and is propagated by division in early spring or early fall.

Phlox paniculata is an exceptional perennial because of its remarkably long periods of bloom. Flowering begins about July 1 and, after a dormant period from August 20 to September 10, resumes and continues through October. Clipping old flower-heads is not necessary, since flower buds are initiated in the old seed-heads and will produce panicles similar to the original ones. For more desirable

Tradescantia virginiana 'Valour'

Artemisia albula 'Silver Queen'

Rudbeckia fulgida 'Goldsturm'

Above. *Lysimachia clethroides*

Right. *Heliopsis scabra incomparabilis*

effects the heads can be sheared after the first flowering; this will induce lateral buds below the cut and result in a flatter, wider inflorescence for the second blooming. Another advantage in shearing is the removal of seed before they fall to the ground, germinate, and develop into seedlings of undesirable reverted types.

New growth in the spring may be sheared when it is from eight to fifteen inches high, and this will promote a shorter plant of bushier habit and a flatter inflorescence. *Phlox paniculata* flourishes in a moist, well-drained, rich loam in which has been incorporated a substantial amount of organic material. It responds very well to peat moss.

The commercial technique in propagating this phlox is to take root cuttings and plant them upright in a peaty soil with a one-inch covering of the peat-soil medium during October and November. The bed is covered with twelve inches of leaves for the winter, during which a callus is formed at the end of the root cutting. In early spring the mulch is removed, and the callus differentiates into stem. The cuttings develop into small plants which mature about the first of June and are then ready for planting out in the field. Terminal cuttings may also be taken in May and June; when rooted, they are planted in the field. If small quantities are desired, propagation by division in early spring or mid-fall may be less arduous.

Phlox paniculata will tolerate light shade, but in full sun growth is shorter, stems are sturdier, and flowers are more abundant. It has one major drawback—it requires spraying at three-week intervals from May through September. Fungi cause leaf spots which appear first on the lower leaves and gradually spread to the top of the plant; the leaves eventually shrivel and die. The fungicide "Captan" gives adequate control. During cool moist periods powdery mildew—a whitish mold on the surface of the leaf—retards some physiological processes but the chief trouble from this disease is the impairment of the beauty of the plant. I have found "Acti-dione P. M." to give effective control. Probably the worst problem with *P. paniculata* is the stippling of the upper surface of the leaves from the feeding of the minute two-spotted mite. This may be severe during summer but can be effectively controlled with "Kelthane." By applying the proper chemicals at the appropriate times, the gardener can reduce attacks from insects and disease to a minimum.

There are over a hundred cultivars of *Phlox paniculata.* The following are among the superior ones. 'Brigadier' has brilliant salmon-orange flowers and grows four feet tall. 'Bornimer Nachsommer' is an extremely sturdy plant with beautiful large panicles of pale salmon-pink—it is one of the best recent introductions. 'Elizabeth Arden', a medium-short phlox, is a prolific bloomer; its pale pink flowers have a lavender tint. 'Mia Ruys' because of its compact, bushy habit, is becoming quite popular; its flowers are white. 'Prince George' is a strong, durable phlox with vivid red-salmon flowers. 'Progress', another robust cultivar, has huge lavender-blue blooms with deeper eyes. 'Starfire' is without doubt the finest deep red phlox to date because of the brilliance of its color. 'World Peace' carries its clear white inflorescence on very strong, tall stems.

Rudbeckia fulgida 'Goldsturm', with deep yellow flowers, three and a half inches across, blooms profusely and continually from June 25 to October 15. A compact plant, rarely taller than twenty-six inches, 'Goldstrum' does not spread through the garden. It will tolerate the hottest position in full sun and thrive in many kinds of soil. I have not yet encountered any insect pest or disease that requires spraying. *R. fulgida* 'Goldsturm' is propagated by division in April, May, and October.

The new hybrid *Tradescantia virginiana* 'Valour' has large, deep purple-red flowers which, as with most tradescantias, last only until two o'clock in the afternoon. It flowers from July 15 to October 15, grows well in full sun or light shade and in a wide range of soils, and has few insect or disease problems. It is propagated by division.

SPRING GARDEN PARTY CANCELED

We regret that it has been found necessary to cancel the Spring Garden Party on May 17, 1961. The rehabilitation of the Museum and Administration Building has taken longer than anticipated, and facilities are not available for the programs planned for this event.

CHRYSANTHEMUMS FOR THE CONNOISSEUR

By Cornelius Ackerson

Mr. Ackerson is past president of the National Chrysanthemum Society Inc., U. S. A., a member of its Board of Directors and Editor of its publications. He is the author of *The Complete Book of Chrysanthemums* and maintains an active interest in many phases of horticulture.

MANY PLANTS will grow from seeds to bloom in a few months with very little care. This is, of course, a fortunate situation for the lazy gardener, since he labors little and profits much, but having put little of himself into his garden, he cannot claim the credit for the floral results which rightfully belongs to a bountiful nature. With chrysanthemums, roses, lilies, and other favorite flowers, the gardener's care shows up in the final results, for without "tender loving care" the blooms are mediocre.

In floral evolution the composite family, of which *Chrysanthemum* is an important generic branch, represents the most recent major development. Yet the continuous hybridization of this genus reaches back over twenty-five hundred years, a record not exceeded by any other ornamental plant. While lilies, roses, and other ornamentals have been hybridized periodically by a few for the enjoyment of many, chrysanthemums have been hybridized by amateurs in their own gardens as well as by professional growers throughout the world. It is relatively easy to cross two chrysanthemums, and the resultant seeds will produce blooming plants the first year if sown early. This has led to the development, from the small daisy-like species native to the Orient, to fifteen distinct classifications of flowers which are recognized by the National Chrysanthemum Society Inc., U. S. A. In addition, the Japanese growers have developed several bizarre forms of blooms that are not generally grown elsewhere. The average gardener recognizes the single and small double bloom forms as garden "mums," but he invariably thinks of the large blooms displayed in florists' windows as special kinds which can be grown only in greenhouses by experienced gardeners. Many an average gardener has, however, learned the simple rules for growing these exotic blooms in his garden. They demand a cultural schedule that requires more time and effort than are required to grow annuals, but the results are far more satisfying.

Before the age of printed history, Chinese chrysanthemum growers had developed large globular-shaped blooms with each floret arranged in a vertically incurved position to enhance the circular symmetry. Excellent examples of these Class 6 blooms are shown in the foreground and upper left of the illustration on page 86.

When Japanese gardeners acquired plants from the mainland, they grew them with such zeal that the chrysanthemum soon became the national flower of Japan.

They embarked upon a hybridizing program which exploited the irregularity of floret arrangement that the Chinese growers had tried so hard to eliminate, and they rejected the symmetry that the Chinese growers had so painstakingly developed in their blooms. The subject of chrysanthemum hybridization is so complex that it cannot be covered in this article; for those who wish to learn about it the National Chrysanthemum Society has published *The Breeder's Handbook*.*

By nature, the chrysanthemum is a composite flower. The description fits a flower-head that has a central disc of flowers containing a complete set of reproductive parts, stamens and pistils, and is surrounded by one or more rows of ray, or ligulate, flowers which have only the female reproductive parts, pistils. There are two types of florets in every chrysanthemum bloom. If the central disc-florets have been developed through hybridization, and the ligulate florets remain as in a daisy, the bloom is a Class 3 or Class 4 anemone-type. On the other hand, if the ray-florets have been developed while the disc-florets remain inconspicuous, the bloom is either a Class 6 regular incurve or a Class 7 irregular incurve.

The Japanese hybridizers grasped every opportunity to accentuate both the predominantly disc-floret type and the irregular ray-floret type. In developing blooms that accentuated the ligulate florets at the expense of the disc-florets, the Japanese produced some in which the ligulate florets remained closed. Here again it is necessary to explain that hybridization by thousands of gardeners over hundreds of years can produce variations that are difficult to correlate into a standard classification. However, if the ray-florets surrounding the disc remain straight and closed, the bloom is a quill, Class 13; if they are hooked and coiled, they produce a spider, Class 15; and if they remain short and open at the tips like a spatula, the blooms are spoons, Class 12.

The basic culture for chrysanthemums is common to both the hardy garden types and the larger bloom types. Before discussing the special requirements for exhibition-quality blooms, I shall summarize basic chrysanthemum culture:

1. Plant rooted cuttings from your own stock or cuttings purchased from a reliable nursery outdoors after all danger of frost has passed in your particular area. The blooming date does not change with the time of planting, but larger plants are developed from early planting. The best time for any area is one that permits the plants to become established before the heat of summer. Be sure the location receives full sun for most of the day.

2. When the plants are approximately six inches high and making good growth, remove the top half-inch of terminal growth. This is called pinching, and it induces the plant to branch. Pinching of lateral shoots up to August 1 will develop bushy plants which will bear many flowers. Small cushion-type mums are self-branching.

3. Chrysanthemums are shallow-rooted plants, and they require considerable moisture for best results. A mulch of peat moss or other organic material will conserve moisture in the top layer of soil and keep down weeds. The mulch

*This may be obtained from the Secretary, Miss Dorothy P. Tuthill, 345 Milton Road, Rye, N. Y., for $1.50.

should be applied when the plants are small.

4. All good gardeners start with a well-prepared bed which is rich in organic matter. Fast-growing annuals may not require further feeding, but chrysanthemums need extra food to produce maximum results. Start feeding in July on a biweekly basis with a balanced fertilizer. Remember that little and often is the rule. Stop feeding as soon as the buds show color.

5. Prevention of insect and disease infestation is a "must" for good results. Apply a combination spray containing malathion and captan on a biweekly schedule, and at the first opportunity after a heavy rain.

6. After the plants have bloomed, cut them to within three inches of the ground and burn or otherwise destroy all stems and foliage. After the ground has frozen, cover the plants with salt hay or some other loose organic mulch. Chrysanthemums are relatively hardy, but their shallow roots are injured by too much moisture around them during the winter and the heaving of the ground in alternate periods of freezing and thawing. Some growers dig up the plants and store them over winter in a coldframe. Whatever you do, be sure the plants are properly labeled and, as an added precaution, make a scaled drawing that locates each variety.

A mass of flowers on well-proportioned plants should be the aim of the gardener who grows chrysanthemums for landscape effect.

The connoisseur who desires large spectacular blooms must direct his efforts so that each one of his plants will produce only one, two, or at the most three blooms. He will start with rooted cuttings and plant them twelve inches apart in rows that are a minimum of twelve inches apart. For ease in handling the plants, he will allow a path every four rows so that plants in two rows can be reached from a path.

Depending upon the planting date, large-bloom plants will grow to an ultimate height of six or more feet so that a positive method of support is required. A gardener who has only a few plants may find quarter-inch steel stakes or bamboo stakes adequate, but it is difficult to get stakes of the proper length. After partial success with several methods, I devised the ideal system that meets all requirements. I have one wire stretched tightly along each row at a height of six inches and a second tight wire at a height of eight feet directly above. I tie a piece of mason's twine between the wires at each plant. I find that a simple over-and-under tie, with the loose end doubled over to make one half of a bow knot is best, since a pull on the free end will release the twine from the wires. It is neces-

An excellent grouping of pot-grown chrysanthemums in a Japanese garden. In the left foreground is 'Taiho Bizan', twenty inches in diameter, and an example of irregular incurve, Class 7.

sary to tie all the twine in a given row with the same degree of tension to give uniform support.

The first pinch is made just as it is with bush type plants, and usually three lateral branches will develop. When these are an inch or so in length, the best in vigor and angle from the vertical is retained; the others are carefully removed. Only one additional pinch is made, but this so-called *time-pinch* is so important that it will be necessary to delve into the peculiar blooming habit of the chrysanthemum before any instruction can be given on the time to make the second pinch.

A typical, irregular or Japanese incurve bloom, Class 7.

All chrysanthemums if allowed to grow naturally will develop a bud in the terminal growth of the plant, usually in June on plants that have been set out in May. This is the *break bud,* and it never becomes much larger than a pinhead. Lateral branches are formed below this bud and continue the upward growth of the plant. Approximately a month later a second bud will form in the terminus of each branch. This is the *first crown bud,* and it too will cause branches to develop from a point directly below it. The process may be repeated again on plants that have had an early start. Any *crown bud* can be made to flower if all the buds of incipient branches around it are removed. However, the chrysanthemum has a remarkable built-in-bloom-timing system which will delay flower production until the normal time for a particular cultivar. A crown bud which is forced to wait in the hot August weather of metropolitan New York will surely be well "cooked" by October.

Finally, as the weather turns cool, a larger bud is formed in the terminal growth of each branch. This is called the *terminal bud,* since it is the last in the series of buds which have been produced. Unlike the crown buds which have a potential flowering bud in the center surrounded by vegetative buds, all the buds surrounding the central terminal bud will bloom. Obviously a lot is left to chance if the plants are permitted to grow naturally. Also there will be a lot of crowded blooms instead of the one perfect specimen that a grower can produce on each stem.

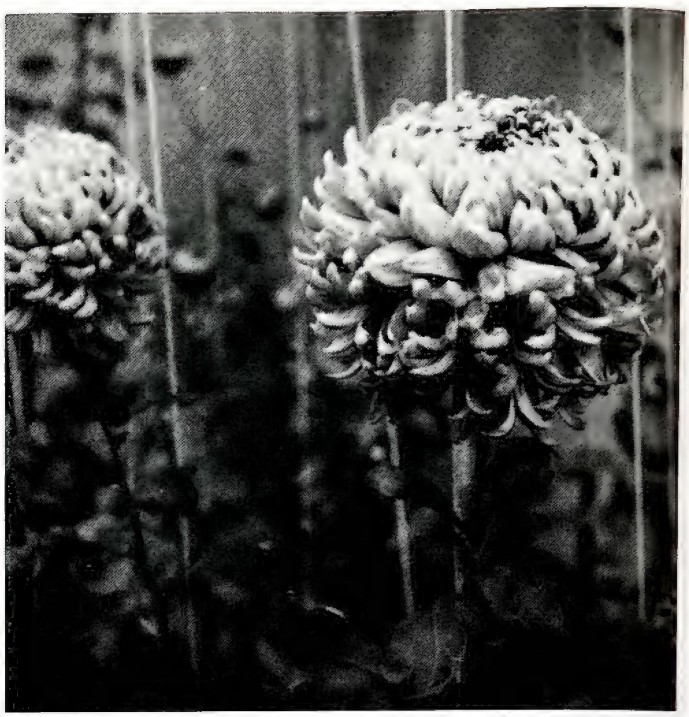
It would seem as though the chrysanthemum puts forth its sequence of buds to probe for favorable blooming conditions just as a mariner does who holds a moistened finger aloft to test the wind direction. Actually the process by which the chrysanthemum produces crown or terminal buds is still a mystery, but we do know that length of day controls the date of blooming. When the hours of darkness begin to exceed those of daylight, chrysanthemum plants begin to form terminal buds. This period begins about August 15 in the latitude of New York. Some cultivars take only six or seven weeks of short days, while others require up to fifteen weeks to go from vegetative growth to blooming. Commercial growers have developed a grouping system which places each cultivar in a six- to fifteen-week category in accordance with its short-day require-

The exotic spider or Fuji type of bloom that is designated Class 15 by the National Chrysanthemum Society, Inc., U. S. A.

ments. Thus most of the early-blooming hardy garden 'mums' are in the six- or seven-week group. The larger blooms that the connoisseur would grow are in the nine- and ten-week category.

Now that we understand the method by which each chrysanthemum cultivar is induced to bloom at approximately the same time each year, we can fit the culture to the pattern. After the plants are making good growth on the one stem that we permit to develop from the first pinch, we know that nature will produce a crown bud. However, if we beat nature by making a pinch at the right time, we shall produce branches which will make uninterrupted growth until a terminal bud is formed. We know that our nine- or ten-week plants will begin to receive the short-day influence about August 15, and they will then bloom the last week in October or the first week of November. We should make the time-pinch long enough be-

Above. Bud development from a time-pinch. Note the plastic-twist tie to hold the plant to its support.



Right. 'Detroit News', a late crown-bloom of exhibition quality.

fore August 15 so that the resulting flowering stems will be ready for the short-day treatment. On the other hand, we must not make the pinch too early or a crown bud will form. In that case we either remove all the side buds and hope for a good bloom, or we allow one lateral to grow on to become a short-stemmed terminal bloom. Experience indicates that the time-pinch should be made approximately ninety to one hundred days before the normal blooming date of a given cultivar. This will produce a late crown or a terminal bud.

Generally speaking, the blooms from a crown bud have more florets, but they may not have the best color; while blooms from a terminal bud may lack full form from fewer florets, but the color is more intense. The connoisseur should try to make his time-pinch so that a late crown bud is formed. A one-hundred-day pinch is more apt to produce a crown bud than a ninety-day pinch. The crown bloom will have a few short bracts in place of true leaves directly below the flower-head: these may be seen in the illustration on page 88. Two branches are developing from the time-pinch made on the plant pictured on page 88. The one on the right departs from the vertical stem at a better angle than the one on the left, so it will be retained.

In all but the higher areas around the mid-Atlantic seaboard a frost usually occurs about the end of October, and this is generally followed by a warmer period which lasts well into November. Since the greatest number of large-bloom chrysanthemum cultivars flower at this time, many growers take their chance on the weather and hope that frost will not damage their blooms. It is not so much cold weather that causes the damage as it is the effect of the sun's rays on frost-encrusted blooms. White petals are affected more than bronze or red ones. The plants will stand a low of 28° F, provided they have overhead protection. Such temporary protection as sheets or newspapers may be used if there are only a few plants.

The plastic cover is being installed in mid-October over the pipe-support frame.

These blooms approach maturity under the plastic cover in November.

SOME OUTSTANDING CULTIVARS FOR THE CHRYSANTHEMUM CONNOISSEUR

NAME	NCS CLASS	COLOR	BLOOMING DATE	REMARKS
'Silver Sheen'	6	White	October 20	A good early white
'Mrs. Kidder'	6	Yellow	October 20	An old favorite
'Roseum'	6	Pink	November 1	Excellent incurve
'Amber Bright'	6	Bronze	October 15	An English import
'Zylon'	6	Red	October 25	Rich color
'Pale Moon'	7	White	November 1	Creamy white
'Oriole'	7	Yellow	November 1	A great exhibition bloom
'Rose Bowl'	7	Pink	November 5	Deep orchid-pink
'Chambrier'	7	Bronze	October 20	A new gem
'Muto's Crimson'	7	Red	November 5	Gold reverse on petals
'Dunlop's White Spider'	15	White	November 1	Stiff stems, large blooms
'Luyona'	15	Yellow	October 25	Best yellow spider
'Bunbu'	15	Pink	November 1	A constant NCS winner
'Waikiki'	15	Bronze	November 5	Delicate shading to orange
'Emerald Isle'	15	Greenish	November 8	Most unusual

The connoisseur, however, will not run the risk of having his summer-long efforts wasted in one night. He plans ahead for protection that can be easily put up in advance and removed at the end of the season. My twenty- by forty-foot chrysanthemum area presented a protection problem which I solved by using a relatively heavy gauge plastic covering over a pipe-support frame set in concrete posts. The newer types of outdoor plastic materials make excellent frost covers, provided the roof is kept taut to prevent water-collecting pockets. I have found that the weight of a piece of 2 × 4 lumber attached to each edge will keep the top tight. It is advisable to have a hem large enough to slide in a piece of 2 × 4 on each side; this hem can be made by a heat-seal process at the factory.**

The hobby of growing chrysanthemums is most rewarding, for there are so many possibilities for cultural exploration. Chrysanthemums may be grown in pots to produce large specimen plants or cascades; they may be shaded with black cloth to induce earlier blooms; they may be grown under lights in a greenhouse to inhibit bud initiation. An avid interest in chrysanthemums may be satisfied by joining with other hobbyists in one of the chapters of the National Chrysanthemum Society in the metropolitan area. This year the Society's annual meeting and show will be held at Garden City, Long Island, on October 20-22, with the Long Island Chrysanthemum Society as the host chapter.

**The X. S. Smith Co. Box 272, Red Bank, New Jersey, will supply plastic covers made to measurement at reasonable prices.

A COUNTRY HOUSEWIFE'S GARDEN

By GERTRUDE B. FOSTER

Mrs. Foster is Editor of *The Herb Growers' Magazine.*

"A ROSE is a rose is a rose," is not always a rose, nor does a rose by any other name always smell as sweet —not, at least, when it is a salad burnet or another herb of the *Rosaceae* or rose family. However, lack of petals, the glory of the familiar rose, and lack of sweet perfume do not diminish our fondness for two very different members of the rose family with time-honored herbal significance. Only a taxonomist or botanist can recognize the relationship of the lowly burnet, *Sanguisorba minor*, the decorative ladys-mantle, *Alchemilla vulgaris,* and the stately bush rose. But the herb gardener, when told of their kinship to the rose, can better understand the need of both plants for excellent drainage and loose soil in which the string-like roots can reach deeply for underground moisture.

The leaves of salad burnet look as if they had been snipped along the edges. They stand out from the stem, the leaflets in a pinnate pattern recalling some of the small-leaved roses; but they grow in thick rosettes close to the ground on stems that are not at all woody. If the plants are started anew each year from seed, the desired cucumber flavor in the leaves, which gives the plant its name salad burnet, is more delicate. Second-year plants have a slight green tang which is not quite so pleasant in tossed salad or steeped in vinegar as is the cool savor of young *Sanguisorba* foliage.

The flowers of burnet are sometimes called "knobs" in English recipes, and this is a very descriptive term. They are in thimble-shaped heads of petal-less blooms which have a rosy color because of the closely-placed, brushy stigmas. The yellow-tipped anthers hang below the thimbles like knotted threads, and it seems as if the stigmas must depend on the wind to fertilize them. No special scent attracts insects, and the upper female flowers are out of reach of the drooping capillary filaments; but many curiously shaped, pitted brown achenes (one-seeded fruits) form upon the airy, long-stemmed heads that stand half a foot above the original rosettes. The blossoms are cut back by the salad fancier to promote the growth of cucumber-like greens; but in England they are allowed to develop and are gathered to make burnet wine, which is described as "the most agreeable to the palate and of a rich ruby colour, tasting like good port wine." If they were gathered as soon as flowering started, the cook could have both burnet wine and burnet vinegar, too.

Salad burnet is not a very long-lived plant in my garden;

(Continued on page 103)

This modern lake-shore stage was formally dedicated in May 1960, during the height of the rose season, with a twilight concert featuring the Centenary College Choir and the Shreveport Symphony Orchestra.

GARDEN IN THE FOREST

By C. B. Byrd

Mr. Byrd is manager of Hodges Gardens, one of America's new show places and part of the transformation of western Louisiana.

TWENTY YEARS AGO, I should have thought west Louisiana the last place in the world where I should see plantations of azaleas, camellia trails stretching through tall pines, and thousands of roses blooming beside a lake. The entire region then was an economic cemetery in the wake of the "cut-out, get-out" era of the lumber industry that had clear-cut pinelands to fill worldwide demand for Louisiana virgin pine.

Because there seemed no hope for this repressed area, most young men moved on to cities for work. I should probably have done the same if I had not become aware of the new type of men moving into the region—forest landowners determined to reforest idle acres. I decided to cast my lot with those who wanted to restore the land.

Today, a new forest covers many of the once denuded acres. Highways are busy with commerce as trucks carry timber and pulp to market. Thousands of motorists are attracted here to enjoy plantations of flowers and historic lore. It has been a rare experience to watch a land come "From feast to famine and back again."

The most dramatic outgrowth of reforestation in west Louisiana is Hodges Gardens, Experimental Area and Wildlife Refuge. This conservation area of forty-seven hundred acres is located on Highway 171, midway between Many and Leesville, Louisiana, and is in the center of the rejuvenated pinelands. The land on which Hodges Gardens is located was purchased with other tracts some twenty years ago by the A. J. Hodges Industries of Shreveport, Louisiana. It lay half in the so-called longleaf pine *(Pinus palustris)* belt, then covered largely by worthless scrub oak thickets, and half in the loblolly *(P. taeda)* and shortleaf pine *(P. echinata)* hardwood area, the latter species coming back in second growth.

Obviously reforestation was the immediate need, so a long-range planting program was started. As work progressed, it occurred to us that something should be done to improve the native pine trees by hybridizing and by selective cutting to weed out inferior trees, so that in time the quality of the entire stand would be better. This kind of upgrading had been realized in animal and other plant life, and we felt it could be accomplished with pine trees.

These observations, of course, were not original. After discussions with Dr. Phillip Wakeley of the Southern Forest Experiment Station in New Orleans and with Dr. Bruce Zobel, who was then with the Texas Forest Service, College Station, Texas, we formulated a constructive plan, and the experimental phase of the Gardens was started. A rugged area of the pine plantations was chosen for the experimental work. It was then we noticed the natural beauty of the area, and the idea for the "Garden In The Forest" was born. Approximately one thousand acres were set aside for an experimental area and gardens. It seemed natural to provide a haven for all phases of native wildlife; thus started what is now Hodges Gardens, Experimental Area and Wildlife Refuge.

Nearly twelve years of thought and planning have gone into Hodges Gardens. The main Gardens lie in the center of what was once an old quarry. The trams that were constructed more than fifty years ago to haul out rocks were logical locations for walks. Steps were laid where one would want to walk from one level to another. Falls were built where heavy rain-water drained. An old swimming hole became a reflection pool.

Little of the rugged terrain was changed. The piles of rock, now covered with a green veil of mosses and lichens, still rest where they were abandoned more than half a century ago. The stately trees now pushing up through the massive rocks grew from seeds which were blown from nearby trees and scattered over mounds of broken stone which were never hauled away.

The old quarry with its hummocks was a natural setting for camellia trails, for these aristocratic flowers from China nestle there among rocks on mountains and hillsides. In Hodges Gardens, the camellia finds a precise duplication of its natural habitat.

The recessed rocks are a natural environment for dogwood, too, as well as for many varieties of azaleas.

The spring season at Hodges Gardens reaches its peak

Upper: Numerous pools are full of exotic water-lilies. Here are table-top pads of the Santa Cruz water-lily, *Victoria cruziana*, measuring up to six feet in diameter.

Lower: Thousands of gay pansies nestle among the rocks that border streamlets running through Hodges Gardens.

the early part of April, when azaleas, dogwood, tulips, pansies, and scores of other plants are in full bloom. Popular at this time, too, is the wild azalea, known locally as "bush honeysuckle." This native shrub *(Azalea nudiflora)* covers the hillsides of Sabine and is an attraction that draws residents outdoors in throngs. Almost as plentiful is the wild yellow jasmine or jessamine *(Gelsemium sempervirens)*. In our refuge we make every effort to protect Louisiana's vanishing wild flowers.

The May bloom of modern roses has made this month almost as popular as azalea season at Hodges Gardens. Thousands of Grandiflora, Floribunda and Hybrid Tea roses in a lake-shore showcase overlook a lake-shore stage. Old roses that were threatened with extinction a few years back grow in a special garden on an adjoining hillside. Here, roses that were popular in grandmother's day climb redwood trellises. On this same site, in a special rose test garden, are the "Roses of Tomorrow."

Because Louisiana is semitropical, Hodges' summer garden is growing in popularity. Here tropical water-lilies flourish in reflection pools, alongside the giant floating leaves of *Victoria cruziana.* Among summer shrubs are *Hibiscus rosa-sinensis,* known as princess of the South as well as rose of China, *Leucophyllum texanum* and *Salvia greggii.* There is also a fine collection of lantanas.

Day-lilies add color to Hodges' summer garden. Cannas, in several colors, give dramatic effect to the landscape until frost with their lush foliage. Garden visitors are especially attracted in summer to the candelabra trees *(Cassia alata)* with their glowing yellow racemes of flowers like candles.

Another interesting and rare plant is the striking crimson fountain-grass *(Pennisetum ruppelii)*. As August ends, the cigar-flower *(Cuphea platycentra)* begins to bloom on its tall graceful wands.

Masses of petunias carpet the beds in the main Gardens during the summer. In this season as in all others, Walter Chalupnik, Chief Horticulturist, strives to achieve masses of color with simple flowers, and at the same time to introduce as many interesting and rare plants as will thrive in our climate.

Throughout the summer and fall, roses dominate the scene and continue until camellias open the winter garden. Thus the year-round cycle begins again.

Across the lake from the main Gardens are two greenhouses which accommodate annuals and also bring the tropics close to home. Our Horticulturist makes this site a brilliant show of color all year long.

Lake-shore Stage

A new "department" has been added to Hodges Gardens —a very effective lake-shore stage on which programs of symphonic music, ballet, chorals, and light opera are staged in warm months. Here, too, is presented the traditional Easter Sunrise Service, when choral groups of the El Camino Real area join with the Centenary College Choir in a

(Continued on page 104)

Flower-bordered steps take visitors from one level to another in the main gardens.

SOME PLENTIFUL WILD MUSHROOMS

By G. G. NEARING

Mr. Nearing is a specialist in rhododendrons—he has been growing, breeding, and writing about them since the late 1920's. He is interested in other plants too. He pursued the study of fungi as a hobby, and wrote and illustrated—with seven hundred line drawings—*The Licheu Book,* as well as popular articles on fungi.

FALLEN LOGS and dead standing trunks of trees are often covered with the bracket fungi, white or variously colored shelves projecting horizontally from the dead wood. There are hundreds of different species in many sizes and shapes, almost all with hard or corky texture and so not good for eating. But frequently after a couple of rainy nights, a crop of oyster mushrooms will appear among them. These may come at any season of the year from Easter until Christmas; more frequently, however, during summer. The same log may produce two, three, even four crops in one year and repeat the following season.

In contrast to the hard bracket fungi, these oyster mushrooms, *Pleurotus ostreatus* and *P. sapidus,* are brittle and tender, with moist flesh. Each may be a couple of inches or up to a foot across, white to oyster-gray, stretching sidewise on a short, fat, curved stalk. The stalk is almost always off center, and may be at the very edge of the oval or circular cap. Gills (the radiating blades on the under surface), like those of the common mushroom, run down the stalk, often almost to its base. They are white or very pale gray.

Oyster mushrooms may last one or two days in good condition before the worms invade and destroy them, or they may become wormy after only a few hours. Sometimes one log will yield twenty or thirty pounds at a picking.

No poisonous species is likely to be confused with *P. ostreatus* or *P. sapidus.* The deadliest of toadstools grow on the ground rather than on logs or trees and have a central, usually straight, slender stalk. A couple of somewhat poisonous species vaguely like the oyster mushrooms are tough, stringy, woolly, and astringent, and would hardly be eaten by mistake.

The favorite trees on which oyster mushrooms grow are oak, hickory, tulip-poplar, and maple, but they also occur on other trees.

They should be cut into small pieces, and the base of the stalks and any parts infested with maggots should be discarded. No peeling is necessary—any dirt may be scraped off. After they have been boiled slowly about forty minutes in just a little salted water, with the lid on the kettle, they may be eaten that way or be put for another five minutes in a frying pan with any sauce appropriate to mushrooms. The flavor varies with the season and the conditions of growth, but it is fully as good as that of the commercial mushroom.

In like places and over the same long season, one will sometimes find the sulphur mushroom, *Polyporus sulphureus.* It does not appear twice on the same log. A great mass of the sulphur mushroom will grow from a single point of attachment. There is no stalk, but many horizontal fans reach out from the central area, bright orange on top, sulphur-yellow beneath. The under surface has tiny pores instead of gills, each no bigger than a pin-prick.

A single mass weighing ten pounds is not unusual, and there may be several such masses on one log or stump; most of them will weigh only a pound or two. Sometimes clumps will grow from underground roots, and the under surface may then be pinkish instead of sulphur-colored. This has been considered a different species, but the quality is the same.

The flesh of young sulphur mushrooms is very brittle and dry. In this condition, which lasts only two or three days, it is one of the most delicious mushrooms. As it ages, the flesh becomes leathery and unfit for food. This mushroom requires some patience to prepare. It must be sliced across the grain and boiled slowly for an hour and a quarter. After only an hour of cooking, it remains rather tasteless; if boiled too fast, it is poor in flavor. When simmered for the full hour and a quarter, it develops a flavor and substance scarcely equaled by any other mushroom. A butter or cream sauce at this point will still further delight the palates of those who relish such delicacies.

Only two other polypores are as brightly colored. *Polyporus cinnabarinus* is brilliant orange-red above and beneath, but so hard that no one would attempt to eat it. This is also true of *P. croceus,* bright orange, never sulphur-yellow beneath.

In the autumn one may find the bear's head, *Hydnum caput-ursi,* northward or on high hills, growing in a hollow beech, on an oak, or on other wood that is dead but not rotten. It is a shaggy, white mass of drooping spines which almost hide the branching stalks. Clumps weighing several pounds are not unusual.

Variants *H. coralloides,* with longer branches clothed in shorter spines, and *H. erinaceum,* a roundish mass, unbranched, its pendent teeth as much as two inches long, are both equally good eating. But *H. septentrionale,* whose bracket-shaped lobes have the downward-pointing teeth only on the under surface, is tough and has an unpleasant odor and flavor. This is inedible, though probably not poisonous.

The bear's head is a good mushroom, not perhaps one of the most delicious and tending to be a little tough, but it offers palatable food and is unlikely to be mistaken for anything harmful. It requires the usual slow cooking for about fifty minutes.

One of the most astonishing of all mushrooms, the beefsteak, *Fistulina hepatica,* which might even more appropriately be called the beef tongue, appears during late summer and early fall on old, even rotten stumps of chestnut and oak. It grows tongue-like or more widely spreading, with wavy margins, from a wrinkled, sidewise stalk to a length and breadth of several inches, rarely a foot. The upper surface is covered with dark red jelly enclosed in a skin which has the roughness of a tongue, while the red-

Polyporus sulphureus

dish flesh within looks almost exactly like that of beef tongue; a small amount of reddish juice makes the resemblance more startling. The under surface is pink when young, minutely speckled with red. Later the brownish pores open.

During its first three or four days the beefsteak mushroom may be eaten. When cooked it develops a sourish flavor, which some people like, but I prefer to serve it raw in a salad. After I have scraped off and thrown away the jelly, I slice it thin across the grain. It is tender, with a flavor between a mushroom and a tomato.

To mistake the beefsteak mushroom for anything else would be virtually impossible. Superficially it resembles *Polyporus lucidus,* which is much the same in shape and dark red, but hard and rubbery and shining smooth on top. Nothing else approaches it in appearance, and its texture is unique.

Perhaps the most plentiful of all wild mushrooms, one known and eaten the world over, is the honey mushroom, *Armillaria mellea.* It too grows on stumps, logs, and standing dead trees, also from dead tree-roots in the ground. The honey mushroom seldom appears earlier than mid-August and in favorable damp weather through September and October, often into November. Many long, irregularly curving, brown or greenish stalks spring from a central point. Each is surmounted by a typical toadstool-shaped cap, from one to six inches in diameter, brownish or dull yellow above, with the gilled under surface white. Near the top of each stalk is a white, often cottony collar.

Anyone picking the honey mushroom must be alert to distinguish it from the deadliest of all toadstools, the amanita. Both have the typical toadstool shape, with white gills, and in both the spores are white, as can easily be seen where one cap overlaps another, depositing the white dust on the top of the one beneath. There are important differences between the two. The deadly amanita springs from the soil, seldom from rotten wood, individually and not in clumps, and the stalk is upright and very straight. The honey mushroom grows typically in clumps, many stalks rising from a single point in the dead wood, and few of these are either straight or upright; they tend to sprawl in all directions. Both have a ring on the upper part of the stalk, but in the amanita this takes the form of a thin veil, often drooping, while in the honey mushroom it is an outward-spreading collar usually more or less cottony.

Growing in just such clumps is the jack-o-lantern, *Clitocybe illudens,* indigestible or slightly poisonous, but not deadly. It is brownish orange above and beneath, with no collar on the stalk. The honey mushroom, though often dull yellow, is never any shade of orange above and is white or slightly brownish beneath. Other species grow in clumps on wood. Most of them are edible; none is really dangerous.

The name honey mushroom refers to the frequent honey-color of the cap, not to the flavor, which is moderately good but not sweet. The stalks should be discarded, the caps cooked about forty minutes, and then a sauce added to take up a certain sliminess which is not appealing to all tastes. Nevertheless, if one judges by the enormous quantities of this species which are collected and eaten, it must be generally liked.

Mushrooms that grow on the ground should be picked with greater caution than those found on logs and trees. While the wood-inhabiting species could be mistaken at worst for some which are indigestible or mildly poisonous, the species growing on the ground must be distinguished from the deadly amanita.

Perhaps the easiest of all to distinguish is *Hydnum repandum.* This is shaped like a toadstool, buff or brownish on the upper surface of the cap, but when turned over is found to have downward-pointing, whitish spines or teeth like those of the bear's head in place of the radiating gills of the typical mushroom or toadstool. Other hydnums grow on the ground; these are mostly blackish or dark brown, and woody in texture. *H. repandum* has a tender flesh like that of the best of mushrooms and, when cooked about forty to fifty minutes, an agreeable flavor. It is found on the forest floor throughout summer and early autumn, and is fairly common everywhere when the weather suits it.

Mushrooms that have the toadstool shape, but pores on the under surface instead of gills or spines, grow plentifully in the woods all summer and well into autumn. There are more than a hundred species; most of them are edible, but a few are reputed to be poisonous. The safest of these for eating is the pine cone mushroom, *Strobilomyces strobilaceus.* The cap is covered all over with blackish tufts of web-like material; the under surface (of tubes or pores) is grayish white, eventually turning blackish.

Once seen the pine cone can scarcely be confused with any other fungus, though there is a blackish boletus without the tufts which is also edible. Not only safe, it is de-

licious when it has been cooked for forty minutes, the stalk, tubes, and scurfy top surface having been removed. This species is plentiful throughout the summer on woodland banks and slopes.

Typical of this group is *Boletus scaber,* with a smooth cap in various shades of brown, yellowish, and reddish, and pale gray tubes. It is named for the very tiny wart-like growths scattered along its stalk. This and related species may be gathered for food with little risk of poisoning. All require rather long, slow cooking; only the thick flesh of the cap is used, from which the tubes of the under surface have been stripped away.

The mouths of the tubes of the only related poisonous species are conspicuously red, making the under surface red. It is not known just how poisonous they are. But *Boletus felleus,* the largest and fattest of them all, and intensely bitter, is to be avoided. It is distinguished by the pinkish or flesh-colored tubes under a light brown cap, but its bitter taste is the surest warning.

Most species of *Boletus* may be eaten. They are much sought after in Europe, also in this country by people of European origin who are familiar with them under the German name *steinpilz* or the French *cèpe.* After being cooked for thirty minutes or more, they may be served in a variety of ways with equal relish.

Perhaps the safest of all mushrooms is the puffball, a more or less spherical body growing on the ground, sometimes on logs or stumps. Some species are very small, others large—up to a foot or more in diameter. When these mushrooms are young and fresh, their whole interior is a pure white dough-like flesh, and excellent for eating. The outer rind must be peeled off, and the flesh sliced or diced before it is cooked for forty minutes or so.

Sometimes a hillside pasture in early fall will yield several bushels at one picking of *Calvatia gigantea* or *C. cyathiformis;* both are equally good to eat. A log or stump may be covered with *Lycoperdon pyriforme,* enough to fill a large basket, even though each mushroom is only an inch or so in diameter.

As long as the whole interior is pure white, all are edible, with one exception explained in the next paragraph. Age, however, turns the flesh purplish or greenish, and with this change in color bitterness sets in, and the puffball is no longer fit for food. Eventually the whole turns dark green, gray, or purple and becomes a dry dust which puffs up in a cloud if the fungus is stepped on. This dust consists of spores by which the species is perpetuated.

The exception is a little golden-yellow or brownish puffball, *Scleroderma vulgare,* common in the woods on banks or roots of very rotten stumps. Covered with scales, it is tough and poor in texture and quickly turns purple, then black within. I have eaten it when it is white, but some find it indigestible; as it has an inferior flavor, it should not be gathered for eating, but it is not dangerous.

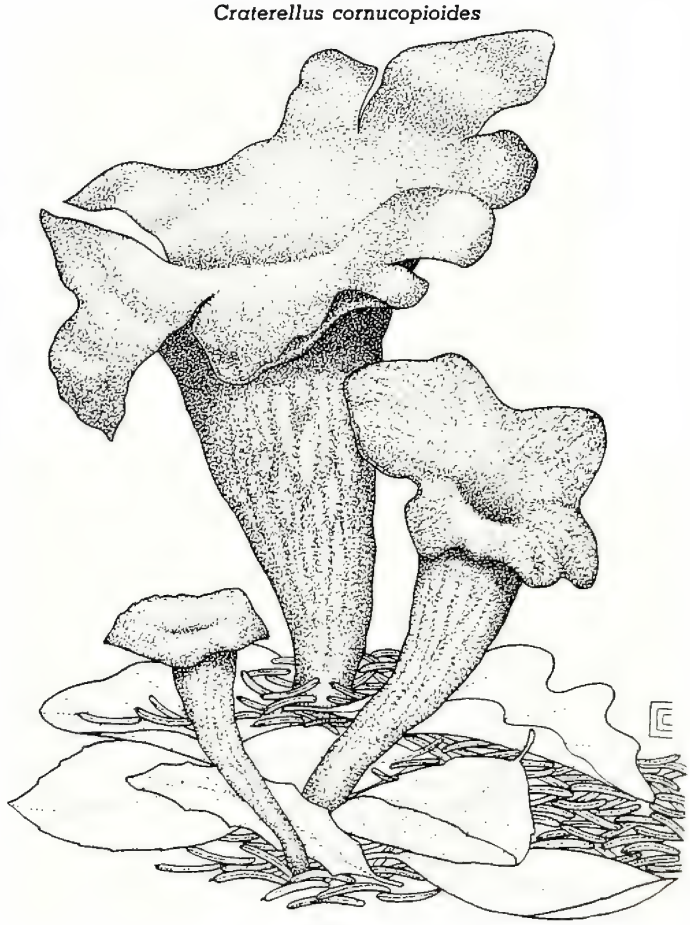
When an exceptionally large *Calvatia gigantea* is found in a field, it may present a problem. If collected, much may go to waste for lack of time to prepare and cook it, for one specimen may weigh twenty pounds or more; if left in the field, it will soon turn color and be spoiled for eating. The best thing to do is to slice off and use the top of *C. gigantea* and leave the rest growing in the ground. This slicing will delay maturity, and a second slice may be removed the next day, and so on for several days. If a number of large puffballs are found together, each may be sliced in this way, and the aging will be delayed until all can be used. But if one has time to prepare and cook a large quantity, it is better to gather them all at once and do so. What is left can be warmed over; the flavor will improve for at least four days.

The manna of the Israelites was probably a puffball rather than any of the many other growths with which it has been identified. The word manna originally meant a gift, or something that could be collected in the wild, something one could get for nothing. Different wild products are still called manna in that region. The wording in the Bible describes accurately a little puffball, *Lycoperdon curtisii,* or one of its close relatives growing in Asia Minor. There are a number of quite similar species widely distributed in the world. No other known growth agrees with the description of manna in the Bible.

Almost as safe as the puffballs are the coral mushrooms, upright simple clubs or variously branched bodies—a host of species, most of which make moderately good food. *Clavaria flava,* uniformly pale ochraceous yellow, with fleshy, almost parallel branches, forms dense clumps three or four inches high. Forty-five minutes of slow boiling will convert *C. flava* into excellent food, if found before it has been infested with maggots.

Clavaria formosa resembles *C. flava* in shape, but its color is pink or salmon with yellow tips; when old the entire plant fades to a yellowish color. *C. formosa* has now been declared poisonous to some people. Older books com-

Craterellus cornucopioides



mend it, and I have eaten it without harm, as have many of my friends. It is not deadly, but should be treated cautiously. Perhaps some specimens, or strains growing in certain localities, contain a small quantity of poison.

Clavaria amethystina of similar branching habit, but usually more open and quite variable, is difficult to mistake because of its pure violet or rich lavender color and translucent flesh. Other coral mushrooms may have a gray or purplish tint, but these are also edible unless too tough and woody. *C. amethystina* is particularly brittle and tender.

A clavaria which does not branch but forms a little club two to four inches high, buff, gray, or brownish, is one of the best. This is *C. pistillaris,* which is found in the woods throughout the summer. It is much thicker near the top than are other unbranched species which occur in many sizes and colors; none is dangerous.

Some species of *Clavaria* and of the somewhat similarly shaped fungi *Thelephora, Stereum,* and *Tremellodendron* are tough and woody and should not be considered for food. They are probably not poisonous except for the doubtful *C. formosa.* All that are tender are edible.

On rather damp flats and banks in woods, particularly where beech trees grow, the black trumpet will be seen by anyone with superior eyesight. It grows from June to September in favorable damp weather and may be looked for in the same spot several times a season, for it recurs there year after year. It is well to take note of such a place, because to find this mushroom at all is an achievement. One searches for it, his eye finally lights on it, but he may look everywhere in the vicinity and see no more than this one. Then as he stoops to pick it, he sees another a few inches away, where he had previously looked and seen none. He moves his foot and finds that he has stepped on one or two, lifts his basket only to discover that it has crushed a couple, then searches the same area again on hands and knees and finds dozens more.

The black trumpet, *Craterellus cornucopioides,* is black or brown and nearly invisible among dead leaves and against banks of moss. It is two or three inches high, shaped like a tin horn, and becomes wavy and wrinkled as it ages. After picking it, one could blow through it.

For about a week it remains edible, but then maggots invade it, or it dries or rots away. *C. cornucopioides* is my favorite of all mushrooms. When it is boiled slowly for about forty minutes, it is delicious. There is no harmful fungus with which it could be confused. *Urnula craterium* is urn-shaped rather than trumpet-shaped, and while it, too, is black, it does not appear to be injurious.

Weather that brings out the black trumpet also favors the chanterelles. One of these, *Craterellus cantharellus,* is related to the trumpet and of somewhat the same general shape, but usually larger and fatter. Instead of being black it is egg-yellow, and instead of having a hollow center, it is well filled with a crisp white flesh. *Cantharellus cibarius* and *Craterellus cantharellus* look so much alike that at first glance one would suppose them to be the same, little wavy-edged yellow trumpets scattered about the damp woodland floor. However, the outer or under surface of the stuffed trumpet is merely wrinkled in *C. cantharellus,* and in *C. cibarius* it is covered with gills, not the paper-thin gills of most toadstools, but thicker, blunter ridges, rather widely spaced and conspicuously forking once or twice as they run upward.

Both forms are excellent food, celebrated in France as chanterelle, in Germany as pfefferling. The German name suggests the taste of the raw flesh, slightly peppery, but when cooked the usual thirty to forty minutes, it is wholly delicious. Another growing in similar woodland sites, but especially on banks of moss, is the cinnabar chanterelle, *Cantharellus cinnabarinus.* This is smaller and a brilliant reddish orange, fading to pink, but otherwise it is very much like *C. cibarius.*

All these trumpet-shaped mushrooms retain their color when cooked, except the black trumpet, which cooks up blacker. When stewed together, the striking black, red, and yellow elements mix in an unusual dish to set off the superb flavor.

Cantharellus aurantiacus is the same shape and size, and of a brownish orange color. It differs, however, in one important respect: the gills are paper-thin and closely crowded, contrasting with the thickish, widely spaced gills of the other species. Their only similarity is the characteristic forking. Recent writers have declared it edible, not poisonous as it had been thought to be.

It must be remembered that when a deadly amanita is placed in the same basket with edible mushrooms, and left there an hour or two, all the mushrooms in that basket become poisonous, no doubt because of the amanita spores shed upon them. Some poisonings recorded from a particular fungus eaten by the victim may have been caused by

(Continued on page 103)

When collecting edible fungi, one must be ever on the alert for the deadly amanita.

The glossy green leaves and the fruit clusters of *Viburnum cassinoides.*

The sparse black fruit and the well-developed buds for the next season on *Viburnum acerifolium.*

The drooping red fruit clusters of *Viburnum setigerum.*

VIBURNUMS THROUGH THE YEAR

By DONALD R. EGOLF

Dr. Egolf is Cytogeneticist at the United States National Arboretum, Washington, D. C.

(Continued from the March-April issue)

During mid-May the majority of the viburnums produce their abundant cymes of fertile creamy white florets. The mass display of such species as *V. acerifolium* (4), *V. cassinoides* (4), *V. dilatatum* (5b), *V. hupehense* (6), *V. lantana* (4), *V. lentago* (3), *V. lobophyllum* (6b), *V prunifolium* (4), *V. setigerum* (6), and *V. wrighti* (5b) is noteworthy for only a few days. Although the display may be brief, it nevertheless contributes to the usefulness of these species that are more effective at another season.

The "snowballs," composed of globose clusters of enlarged sterile florets, are among the showiest of the viburnums. However, since the florets are sterile, their ornamental value is entirely dependent upon the flower display. *V. opulus roseum* (3b), the European snowball, was commonly planted by the early settlers and is frequently associated with lilacs in Colonial gardens. *V. macrocephalum* (7), the Chinese snowball, is the least hardy and cannot be grown successfully north of Baltimore unless in a well-protected location. The inflorescence of the Chinese snowball may be as much as eight inches in diameter, in sharp contrast with the four-inch leaves. The Japanese snowball, *V. plicatum* (5b), is one of the most adaptable but will not withstand severe winters. This plant is more generally known as *V. tomentosum sterile,* but *V. tomentosum* is not a valid name, and the plant with the fertile florets encircled by sterile florets should properly be identified as *V. plicatum tomentosum* (5). Since aphids are not a serious problem of *V. plicatum,* the home gardener who desires a snowball would do well to plant this species rather than *V. opulus roseum.*

Viburnum plicatum tomentosum, the double-file viburnum, is one of the species that contribute to the late spring display. It rates near the top of any select viburnum list, with its architecturally tiered branches lined with twin rows of cymes. A mature plant may attain a height of nine feet and possibly an even greater breadth of horizontal branches. *V. plicatum tomentosum* is hardier than *V. plicatum.* In the autumn the foliage of *V. plicatum tomentosum* produces some good purplish red hues. The cultivars 'Lanarth' and 'Mariesi' differ little from each other but are more showy than the original species. The cultivar 'Rowallane' (5) is a fine-textured specimen that has smaller leaves, flowers freely, and fruits abundantly. *V. plicatum tomentosum* 'Roseum' (5) is a plant that varies from year to year in performance, depending on the climatic conditions. If the season is cool and the soil slightly acid, a pale pink color will develop in the sterile florets. The horizontal lines of the double-file viburnum are effectively displayed when planted on a slope so that they are viewed from above. *V. opulus* (3b), *V. trilobum* (2), and *V. sargentii* (5) have the same type of inflorescence in late May, but are more conspicuous in the autumn with red fruit. The masses of creamy white panicles of *V. sieboldii* (5) are also well displayed in late spring on a large shrub or tree which may grow to a height of thirty feet.

The anticlimax of the flowering season in early summer is achieved with *V. dentatum* (3) and *V. rafinesquianum* (3), two natives of the Northeast. Neither is as spectacular as some of the earlier-flowering species, but the airy white masses of bloom are worthy of consideration since they are produced when few other shrubs are in flower. The multiple-stemmed *V. dentatum* tolerates shade and moist or dry conditions and is adaptable to naturalistic planting. *V. rafinesquianum* is a refined four-foot-high plant which can withstand extremely dry conditions of road embankments and slate slopes.

The summer foliage of viburnums encompasses many diverse types and textures such as the soft, pubescent leaves of *V. buddleifolium,* the deeply rugose leaves of *V. sieboldii,* the smooth, glossy leaves of *V. prunifolium* and *V. cassinoides,* the stellate-pubescent leaves of *V. plicatum,* and

Above. The multiple-colored fruit clusters of *Viburnum lantana* in late summer.

Right. The red fruit clusters of *Viburnum opulus.*

the evergreen, wrinkled leaves of *V. rhytidophyllum.* The various species complement and contrast with each other to create a pleasing summer-border composition. A number of foliage variants with variegated, yellow, bronzed, or mottled leaves can be displayed to some advantage, but most of these are monstrosities with little ornamental merit.

The fruit display in midsummer gives a pre-season glimpse of what the autumnal exhibition will provide. *V. fragrans* is one of the first to mature fruit that changes from red to black. The brilliant red fruit of *V. plicatum tomentosum* is evident for only a few weeks in early August; then it ripens to black and is devoured by the birds. Likewise, the maturing red fruit on the red pedicels of *V. sieboldii* are readily eaten by the birds; however, the red pedicels remain to provide a contrast against the dark green, rugose leaves.

V. lantana (4) probably affords the best display for the shortest period of time in mid-August, when the fruit clusters contain the brilliant orange-red fruit in various stages of maturity. The dense, rounded *V. lantana* will usually be observed as a six-to-eight-foot specimen, but it can attain a mature height of fifteen feet under favorable conditions. Although the plant is not outstandingly ornamental, it combines good traits with hardiness and adaptability to dry environments so as to provide a useful shrub for northern gardens. *V. lantana rugosum* (4) has larger, darker green, and more wrinkled leaves. *V. veitchii* (6) and *V. cotinifolium* (5b) are similar to *V. lantana,* but are not often cultivated.

Few groups of ornamentals can equal the luminosity of the yellow, red, blue, or black fruit display of viburnums. The fruit extravaganza begins in late summer and continues through the autumn into late winter. Often the fruit display is complemented by the autumn coloration of the foliage; but, in general, it reaches its peak when the leaves have fallen and the fruits are exposed.

The blue- or black-fruited species are usually the least showy, but the change from green to black often includes multiple color of green, pink, and red to black in the same cluster. *V. prunifolium,* black-haw, is one of the most adaptable plants of the genus. The horizontal black branches with abundant spur growth compose a large upright shrub or small tree of fifteen feet. The heavy-textured, glossy foliage assumes a purple-red in autumn at the same time that the fruit is in various stages of maturity before becoming blue-black and covered with a heavy bloom. The southern black-haw, *V. rufidulum* (6), with blue-black fruit, is less hardy. The handsome, glossy foliage assumes a dark blood-red in autumn. The blue fruit is retained until winter on the taller-growing *V. lentago* which develops into a round-topped specimen thirty feet high. The abundant blue-black fruit on the bushy *V. dentatum* is an excellent source of food for birds. The red and scarlet autumn colors of this plant will accent any naturalistic planting. After the fruit has turned blue-black, the glossy green foliage of the symmetrical *V. cassinoides* assumes a clear red. The related *V. nudum* (6) is a larger plant with large lustrous leaves which become dark red in autumn, but it is less hardy. The black fruit of the maple-leaved viburnum, *V. acerifolium,* is insignificant, but the purplish red foliage will enhance any dry acid woodland trail.

Since there are few yellow-fruited ornamentals, the four viburnums that bear yellow fruits are worthy of cultivation. As the fruit matures, it passes from pale yellow to dark orange and brown on *V. opulus xanthocarpum* (3b), *V. sargentii flavum* (5), and *V. setigerum aurantiacum* (6). The first two are also decked with good yellow foliage. The firm, pale yellow fruits of *V. dilatatum xanthocarpum* (5b) persist much longer on the plant and afford a fine contrast when used in a mass planting with *V. dilatatum.*

The persistent red-fruited viburnums are the most highly prized; all are practically of Asiatic origin. The brilliant scarlet fruit of the compact *V. dilatatum,* the linden viburnum, rates first among the red-fruited species. The abundant four-to-six-inch clusters furnish a display from mid-September until late winter. An eight-foot specimen covered with fruit can become a focal point in any garden. The densely pubescent leaves are russet-red in autumn. Select

clones of this plant are now in cultivation, but many plants offered for sale are seedlings which, in all probability, will develop into a heterogenous lot of fruiting forms. These may include inferior plants unworthy of select garden soil. The allied red-fruited *V. wrighti* (5b) is nearly unkown in cultivation in this country. The ovate, glabrous leaves and the glabrous red bud scales distinguish this plant from *V. dilatatum,* which has pubescent leaves and gray-brown bud scales. The plant frequently sold as *V. wrightii* is a more densely pubescent form of *V. dilatatum. V. wrightii* grows to nine feet, while the dwarf *V. wrighti hessei* (5b) is only three feet tall.

V. betulifolium (6) is not a reliable plant in the North and will seldom fruit abundantly. Young plants are sparse-fruiting, but twelve-foot-high, wide-arching plants mature in milder climates and carry a mass of fruit. *V. betulifolium* is often confused with *V. lobophyllum,* which has leaves broadly ovate, abruptly narrowed at the apex, rounded at the base, and with shallow teeth on the margin. Those of *V. betulifolium* are ovate to diamond-shaped and broadly wedge-shaped at the base, and the terminal part is more gradually tapered and coarsely toothed. *V. lobophyllum* (6b) is an upright plant which grows fifteen feet tall; it has red fruits which persist until cold weather, when birds find them a source of food. *V. hupehense* (6) has similar translucent red fruits but is shy in fruiting every year. The slender branches of *V. ichangense* (7), laden with small scarlet fruits, are spectacular in the autumn; but the overall leggy habit of growth of this six-foot species does not make it desirable for the home grounds. The tea viburnum, *V. setigerum (V. theiferum)* (6), is an erect shrub whose branches often arch under the weight of the fruit clusters. Upon exposure to freezing, the fruits become translucent. In northern areas the plant is subject to injury from late spring frosts and is rarely more than six feet tall; but in milder region it will grow to twelve feet tall.

The native *V. trilobum* (2), the American cranberry-bush, is much less extensively cultivated than is *V. opulus* (3b), the European cranberry-bush. In northern areas, the American cranberry-bush cannot be surpassed. Since it grows far north into Canada, it will withstand the severest winter. *V. opulus* is annually disfigured by aphids, whereas *V. trilobum* is immune to this distortion. These species are much confused, and consequently the true *V. trilobum* is cultivated far too little. *V. trilobum* can be distinguished from *V. opulus* by three distinct broad lobes of the leaf, small glands on the base of the petiole, a narrowly-grooved petiole, smooth and light gray-brown branches, and an overall wide-spreading habit of growth. The fruit of *V. opulus* is bitter; that of *V. trilobum* is edible, and it makes fine jelly. The *V. trilobum* cultivars, 'Hans', 'Andrews', and 'Wentworth', were selected for their fruits. 'Andrews' has stout stems which hold the large, late-ripening fruit erect. 'Hans' has medium-sized fruit clusters which ripen in September; and 'Wentworth' is a vigorous, spreading bush which has broad, drooping clusters of large fruits which ripen in mid-August. The lower-growing 'Compactum' produces many thin stems and fruits well. A pink-flowering form has been recently found in British Columbia. The more vigorous *V. opulus* 'Notcutt' may well provide a good replacement for *V. opulus.* The intermediate, five-foot *V. opulus compactum* is free-fruiting and is more adaptable to use in modern landscapes than the tall, coarse-growing *V. opulus.* The third species with deeply lobed leaves, *V. sargentii* (5), can be distinguished by the elongated central lobe of many of the leaves, especially on young vigorous growth; the dark corky bark of the older branches; and the purple anthers. Sargent's viburnum is a plant of imposing upright stature, with heavy-textured leaves. The fruit is usually less abundant than that of *V. opulus* and *V. trilobum.* The autumn landscape is accentuated by the orange-red autumn foliage as well as by the vivid red fruit of *V. opulus, V. sargentii,* and *V. trilobum.*

The large brilliant scarlet fruit clusters of *Viburnum dilatatum.*

RHODODENDRON DISCOVERIES IN MALAYSIA

By David G. Leach

Mr. Leach is a geneticist who is hybridizing rhododendrons on a fairly large scale at his home in Brookville, Pennsylvania. His book, *Rhododendrons of the World,* is expected to be published soon by Charles Scribner's Sons.

In the era of Victorian conservatories and hothouses the so-called Javanese rhododendrons had a great vogue. During the "Mauve Decade" the great arched glasshouses of the wealthy produced innumerable hybrids, exotic in the unfamiliar orange and yellow combinations of the impressively proportioned flowers. These were borne intermittently throughout the year on plants that grew more or less continuously. The floral fashion of that leisurely period vanished with its untaxed riches. Today there are only a few collections of these unusual hybrids in Europe or America; one of them is at Longwood Gardens, Kennett Square, Pennsylvania. The species from which they came have remained, by and large, a group of mystery, intriguing and baffling those who have sought a systematic under-

standing of their distribution and botanical relationships.

The group includes many scaly-leaved rhododendrons of extraordinary interest. The "lost" species, *Rhododendron toverenae,* with the largest flowers in the entire genus, belongs here. It was discovered by Hunstein in 1884 in the Horseshoe Mountains of New Guinea. The immense, fragrant, white flowers were seven inches in diameter and about five inches in length. In 1959 the Rev. Mr. Cruttwell of the Anglican Mission collected it on Mt. Dayman, and it is once again in cultivation. *R. superbum* has great five-inch, carnation-scented, pink flowers. *R. maius* and *R. archboldianum* are also outstanding ornamentals among those with large, fragrant, white or pale pink blossoms. *R. aurigeranum, R. zoelleri,* and *R. brassii* are conspicuous in the group with yellow to orange flowers. *R. konori* is highly regarded by Dr. H. Sleumer at the Rijksherbarium in Leiden, and it has been successfully grafted on *R. ponticum* understock so that it, too, is now in cultivation.

This whole class of rhododendron springs suddenly back into the limelight as a result of several expeditions to New Guinea in the last couple of years and the subsequent publication of Dr. Sleumer's invaluable classification of the more than two hundred and fifty species.

It seems unlikely that the influx of new species from recent explorations in New Guinea will contribute to gardens in the northeastern United States, although some may prove to be acquisitions for the mildest parts of the Pacific coastal region. A few originate at altitudes as low as four hundred feet, but the majority of the New Guinea rhododendrons come from the middle elevations and subalpine forest below thirteen thousand five hundred feet of the high mountains. Perhaps a small group that is found on open grasslands a thousand feet or more below the snowfields, such as *R. stonori* or *R. saxifragoides* which are truly alpine, may be amenable.

The required adaptation is formidable. I scouted some of these rhododendrons in nature in the Indonesian islands and in Malaya, Cambodia, and Viet Nam in the spring of 1960. At that latitude there is little variation in temperature winter and summer, and almost equal length of day the year around. Similarly constant conditions in the warm greenhouse in the United States produce continuous growth and flowering in all seasons on rhododendrons from the lower elevations.

In New Guinea at the higher elevations, the frost line is between seven thousand and eight thousand feet on some mountains, according to Dr. L. J. Brass of the Archbold Expedition, and frosts occur there every clear morning throughout the year and more generally above ten thousand feet everywhere on the island.

The recent publication in Indonesia of Dr. Sleumer's monumental study of the rhododendrons of Malaysia probably foreshadows a complete reshuffling of the classification of the whole genus. It seems likely that we shall once again be thinking in terms of the subgenera, sections, and subsections familiar to botanists from the system in use before 1930. There will be some familiar names in the sections and subsections, but species collectors had better brace themselves for such strangers as *choniastrum, pseudovireya,* and many others which sound equally alien.

In 1958 Dr. Sleumer published *The Genus Rhododendron in Indochina and Siam,** in which he first mentioned the discovery in Sumatra of a non-scaly rhododendron in the Irroratum Series, a group of related species prominent in gardens in mild climates. This new species, subsequently described as *R. atjehense,* takes its place with Miquel's *R. korthalsii* as the most southerly of the elepidote (scaleless) rhododendrons and the only known species of this group that occurs on the islands off the southeastern coast of Asia.

The superb flower of a hybrid Javanese rhododendron.

In the same publication Dr. Sleumer demonstrated that rhododendrons without scales on their leaves and formerly regarded as exclusively southeastern Asian in their distribution extend into the Malay Peninsula. Species allied to *R. javanicum,* the scaly group that produced the Victorian hybrids, occur all the way from the islands of Indonesia to Viet Nam. Perhaps most surprising of all, a constellation of shrubby species of *Rhododendron* named for their resemblance to huckleberries, of which *R. vacciniodes* is typical, covers a vast region from the eastern Himalaya and southwestern China southward into Malaya and even into New Guinea, Formosa, and the Philippines, a tremendous sweep of four thousand miles.

All this entirely changes our ideas of the distribution of rhododendrons. In *The Species of Rhododendron,* published in England in 1930, which has formed the general conception of the genus, the rhododendrons of Viet Nam, Laos, and Cambodia were simply omitted and those of Thailand were passed over lightly. The editor observed, "It has been judged expedient to reserve the Malayan and New Guinea species for future consideration."

Now it is apparent that the Maddenii Series extends into North Viet Nam, Laos, and Thailand. Many in this series of greenhouse rhododendrons have imposing white, scented flowers on aerial shrubs growing like orchids on the limbs of trees. We know now that the beautiful scarlet-

(Continued on page 104)

*In *Reinwardtia,* published by Herbarium Bogoriense, Kebun Raya, Indonesia.

FLOWERS AND THEIR FRUITS

By Harold William Rickett

Dr. Rickett is Bibliographer and Senior Curator of the Library of The New York Botanical Garden.

(Continued from the March-April issue.)

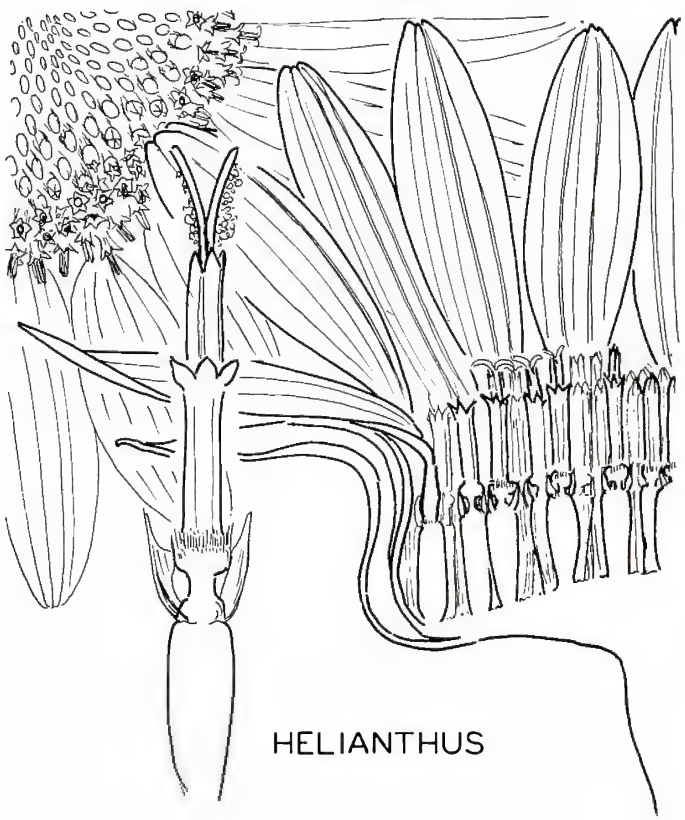
Fruits are various not only in size, color, succulence, and taste, but also in their structure and origin. If we adopt the botanical definition—the matured ovary or ovaries with any parts that adhere—we add to the fruits of our tables a vast assortment of inedible and curious objects—the miscellaneous produce of flowers. The fruit of a botanist (at least during the professional part of his day) is evidently not that of our markets, where apples and bananas are fruits, but tomatoes and cucumbers are "vegetables." The latter share this category with potatoes and cabbages, which have nothing to do with flowers. What is the difference between fruits and vegetables?

To answer this question takes us rather far afield. "Vegetable" meant, only a scant fifty years ago, simply "plant." All plants were vegetables, and all parts of plants were vegetable—as distinct from animal and mineral. On the table "vegetables" came to be contrasted with the meats and other animal products, and so the word became limited to edible plants and parts of plants. Moreover, it somehow acquired its current connotation of plant products served *with* the meat. In fact this is the basis of a legal definition: vegetables are plants and parts of plants served with the meats, while fruits are those brought on with the dessert. So string beans, peppers, and zucchini are vegetables while grapes, peaches, and blueberries are fruits. Perhaps the distinction means something to the legal mind, which may even relish placing cranberries with vegetables and enjoy the resulting ambiguity of bananas. Actually all these things have the same origin—they are all essentially matured ovaries—and for the present discussion any separation of "fruits" and "vegetables" would be worse than meaningless.

As we survey the vast panorama of the flowering world, as we attempt to classify flowering plants, to bring together those with similar organization on the theory that they had a common ancestor in the remote past, we notice certain distinct trends in the evolution of flowers. There is evidence that the earliest flowering plants had large flowers with numerous stamens and pistils. In some other, presumably more recently developed families the flowers are small, with only a few stamens and pistils. The parsley family—carrots, celery, dill—has many tiny flowers massed together in an "umbel," all serving as one large flower (and so considered by Linnaeus). In some of these the outer flowers differ from the inner; the outer larger ones may serve to attract the insects that pollinate them all. The same division of labor is seen in certain hydrangeas and viburnums (as the double-file), in which the outer flowers are sterile, the inconspicuous inner ones providing the fruit. The end of this tendency is the daisy family—the sunflowers, chrysanthemums, dahlias, zinnias, asters, the goldenrods, dandelions, and the ragweeds. The flowers of this family are tiny, complex, closely compacted in "heads" which we mistake, perhaps, for single flowers.

If we cut a sunflower in half, vertically, we can easily see the numerous individual flowers standing erect on a nearly flat disc. Each flower has two "joints"; the lower half is white, angular; the upper yellow, tubular, dilated at the lower end, with five teeth at the upper end. This yellow part is composed of five united petals. The part below corresponds to the stalk of other flowers. It bears at its summit—at the base of the petal-tube—a pair of small pointed scales; these correspond to sepals. As the flower opens, the dark heads of the five stamens—all joined at their edges to form a cylinder—appear from the five-toothed tube. Later the style pushes up through this cylinder, its two branches spreading apart as they emerge and displaying their inner, receptive surfaces. The pollen formed by the stamens will have been pushed out of the stamen-tube by the tip of the style before its branches separate. At the same time the stalks of the stamens coil up in the dilated lower end of the tube of petals, pulling the anthers down into the tube again. In spite of its size, this little flower is far from simple; it has all the parts that a larger flower has and a complex mechanism that, as can be easily seen, prevents it from pollinating itself.

The flowers on the margin of the disc differ in two particulars: their joined petals are extended on one side to form the "ray"; and they have no stamens or pistils. Many composites, such as thistles, have no ray flowers. On the other hand, some, as Indian cup *(Silphium)*, have fertile



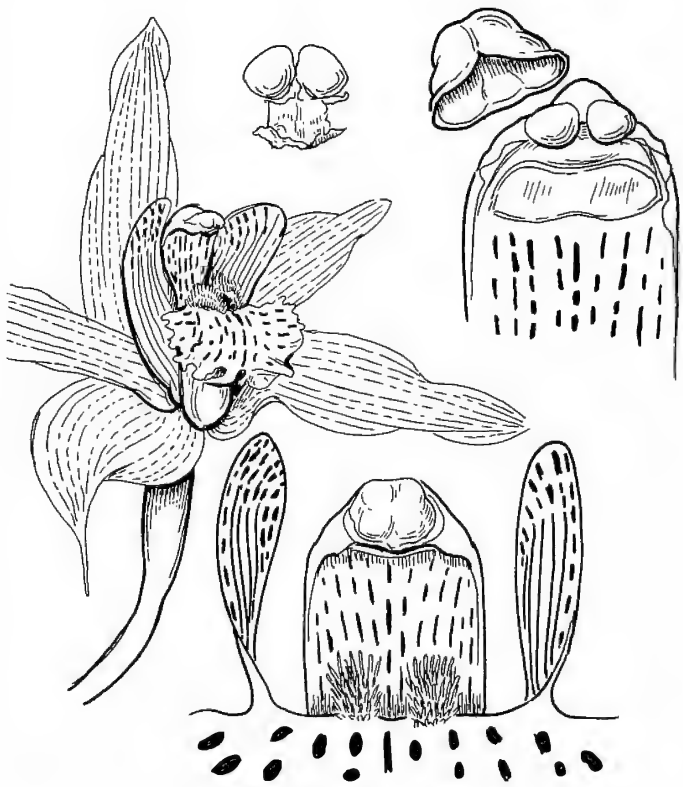
ray flowers that form fruit, while the flowers in the center, the "disc flowers," are sterile. In still others, as dandelions and chicory, all the flowers are like ray flowers and, of course, fertile.

Each ovary in a sunflower is within the part I have compared with the stalk, that white lower part of the individual disc flower. When the seed develops from the single ovule, the ovary remains enclosed by and inseparable from this stalk, and the entire body thus formed becomes the fruit—what we usually call the seed. This is true of all plants in the daisy family. The sunflower "seed" that we feed the chickadees in winter is really a one-seeded fruit. The dandelion "seed" is the same. The parachute of fine hairs that enables it to drift in the air corresponds to the two small scales, the sepals, of the sunflower. Thistledown, which carries a troublesome weed to the farmer's grain-fields, is similar.

All this may seem unnecessarily complex; but one other family must be mentioned to give this story even a slight claim to being complete. The evolution of flowers has certainly proceeded in several quite distinct directions. The end of one trend is the close inflorescence or "head" of small, complex flowers just described. That humble pest, the dandelion, stands near the top of its particular evolutionary tree. Another line led to the almost microscopic, inconspicuous flowers of oak and willows, which also have the essential parts, and little else. But still another group of evolving plants was not content to produce smaller and smaller flowers, but verged towards display, towards gorgeous color and striking form, and finally produced the orchids.

Orchids are so numerous, so complex and various that it is almost impossible to summarize them briefly. As a family they may seem to favor the conspicuous, even the garish colors; but this impression is due chiefly to those that are generally in use for personal adornment. Actually the flowers of some orchids are small and inconspicuous, and no color is lacking from the orchid spectrum; there are green flowers, red, blue, and yellow flowers, white flowers—and all possible combinations.

In structure the orchid flower is organized on a different pattern from lilies, roses, magnolias, and strawberries. These flowers are "radially symmetric"; that is, similar petals, similar sepals extend in all directions from the center. The orchids (and many other flowers) are "bilaterally symmetric"; the petals and sepals on the right mirror those on the left, but those above are unlike those below. They vary as strikingly in form as in color: they simulate in general appearance small insects or doves or dancing girls or slippers. One petal of an orchid, usually the lower, differs from the other parts; it is generally larger, differently colored, of a different shape; it is commonly the most conspicuous part of the flower, as in a cattleya; this is the "lip." Above or behind it is something not seen in any other family, the "column." It may be small and modestly colored, or flamboyant and simulating another petal. It is formed of style, stigma, and stamen (in some orchids two stamens)—all joined. It is on this complex body that botanical interest is focused, for it has its own astonishing ways of accomplishing fertilization. It takes many forms and colors; but the essential parts—pistil, stamen, pollen



CYMBIDIUM

are the same parts as are found in a dandelion or a rose, and accomplish the same results.

In the flower of a cymbidium the column rises at the base of the lip, brooding over it like some small, brightly colored bird with its head pulled back between its wings. At the tip is a white shield; poke a pencil at this and it flies off, disclosing two orange masses of pollen; this then is the stamen, or the head of it. When the intruding point is pulled back, the pollen-masses *come with it.* They are stuck to it by a small transparent flap, on which they stand erect; the foot of this was covered with liquid cement which set immediately when it was exposed to the air. In nature, of course, the pollen-masses are removed by the intruding proboscis of an insect, which thereafter wears them like plumes as it passes from flower to flower.

Within a few seconds of the removal of the pollen, the little flap that bears the pollen-masses contracts unevenly so that they are now brought to a lower position and point forward. When the insect lands on the lip of another flower of the same kind, the pollen-masses will strike the column *just below the stamen-head.* In exactly this position on the column is a broad, lucent disc; this is the stigma. A few (or a few hundred) pollen grains will adhere to this disc, and pollination is accomplished. Many more remain attached to the insect pollinator and will contribute to the fertilization of another flower of the same kind, and another, and another . . .

This is but one of the surprising tales the botanist can tell of the pollination of flowers. One thing that strikes the mind is that flowers seem to go to a lot of trouble to avoid pollinating themselves. But this is not (as Darwin thought) a universal law. There is nothing inherently bad in self-fertilization or "inbreeding." Some flowers, in fact, regularly pollinate themselves generation after generation.

Cross-pollination, however, provides for the mixing of different inheritances and adds to the chances the species has for survival in a changing world.

It is difficult to survey such mechanisms, such apparently purposeful arrangements, without thinking of plants as consciously planning their own future. This seems absurd; the botanist usually offers chance variation and natural selection as an alternative, which places something of a strain on the imagination. What the answer is I cannot say.

EDIBLE FUNGI (from page 96)

the indirect amanita poisoning. Harmless mushrooms may thus have been condemned unjustly; yet it is wisest and safest not to eat any species ever recorded as poisonous.

Among the earliest mushrooms to appear in spring are the inky caps, species of *Coprinus*. *C. micaceus* will cover the whole side of a maple stump or an exposed elm root with little caps so closely crowded that most of them touch each other, and many may be compressed out of normal shape. They are pale buff and helmet-shaped, very perishable and soon turning blackish, for the spores are black. They must be picked before they turn color. They rank with the most delicious of fungi, requiring to be cooked hardly more than ten minutes and are tempting no matter how they are prepared.

The black spores contrast with the white of the deadly amanita, and although some black-spored species have bad reputations, none is deadly. The spores are so black that an ingenious person tried making ink out of them and reported the experiment a success.

Two much larger species of *Coprinus* are often found on lawns and in pastures; *C. comatus,* the shaggy mane mushroom, more or less covered with an irregular coat of long, drooping hairs, and *C. atramentarius,* rather similar but hairless and very smooth except for the striations characteristic of the genus. These mushrooms tend to clump together, but may grow scattered, and always have a helmet-shaped cap, gray to blackening, on a thin whitish stalk. If gathered while they are fresh, they cook to deliciousness in a few minutes; if not picked in time, they soon melt down into a black liquid.

During the month of May, when most mushrooms have not yet made their appearance, the morel is at its height. *Morchella esculenta,* three or four inches high, is shaped somewhat like the ace of spades. The entire head is covered with a pattern of pits and ridges—this pattern should be noted carefully. The ridges may be irregularly arranged or, as in closely related, also edible species, lined up in straight rows, but the spaces between them are deeply cup-shaped. The whole upper part, with this cupped structure, is gray narrowed abruptly into a whitish stalk which is merely wrinkled. The whole structure is one continuous inverted hollow sack.

Verpa bohemica looks very similar, but the upper parts are not continuous with the stalk. Instead, the pits and ridges are on a hood which fits down over the stalk, but barely touches it. *V. bohemica,* too, is edible; however, some people have experienced an odd nervous upset after eating it. This lasts only a short time.

Another mushroom of the same general structure is *Gyromitra esculenta.* The cap and stalk are continuous as in the morel, but the cups are inverted into blisters, with grooves between them instead of ridges. This pattern, opposite to that of the morel, makes identification easy. Some eat *G. esculenta,* while others have been seriously poisoned by it, especially when it is old; it should be avoided. The color is bright brown.

Pastures, orchards, and sloping banks should be searched for the morel, which may easily escape notice. In favorable damp weather, many can often be found. The morel is slightly tough, but very tasty. If stuffed as peppers are stuffed and baked, it makes a most unusual meal. Only the lower part of the stalk need be discarded.

There are hundreds of other species of mushrooms growing everywhere in woods and fields. Most of them can be eaten, many are too tough or disagreeable, and some are more or less poisonous. Those described in this article are among the safest, the best-flavored, and the most plentiful fungi in our region. But for safety's sake, it will be well for anyone who eats wild mushrooms to obtain at least one illustrated book on the subject (several are available) and to become acquainted with other species, edible and poisonous, in order to diminish still further the possibility of a disastrous mistake.

In case of any doubt whatever, a reputable mycologist should be consulted.

COUNTRY HOUSEWIFE'S GARDEN (from page 89)

after two or three years, the basal rosettes rot over the winter. However, seedling plants are usually found about the old ones, no matter how carefully the heads have been cut off. It may be that the soil in the herb garden is not quite sandy enough for the plants. One year I broadcast the seeds upon a gravel bank at the edge of the driveway, and it was soon covered with young plants of *Sanguisorba minor.* They are very pretty in a mass or as an edging for the vegetable garden bed because, as one looks down upon them, he will observe that the unfolding leaves sparkle with drops of dew which linger on them longer than on the grass and other herbage. After three years the bank was quite devoid of burnet clumps, possibly because I had sown tansy seed at the same time and the taller growth of *Tanacetum vulgare* overshadowed the lowly burnet.

On the West Coast salad burnet has been tested as a forage crop for sheep. The deep roots permit the herb to grow under conditions of drought on sandy soil that will not support grasses. In New Jersey it has been planted along the coastal plain by the Wildlife Management Section of the New Jersey Division of Fish and Game, because it provides forage for animals and the seeds are attractive to many species of birds, particularly quail. The work there with burnet for several years has shown that fertilization increases the seed yield and the protein-content of the seed up to sixty per cent. No mention is made of the loss of plants by feeding. An old idea of herbalists that burnet would die out on rich soil seems to have no basis in fact, if other factors such as sunlight and limestone are sufficient. The fat-content of burnet seed is nearly as high as that of soybean seed, and this may explain in part its use by birds as a high-energy food.

Another very attractive but presently less used member of the rose family in the herb garden is the ladys-mantle.

This very hardy Arctic plant *(Alchemilla vulgaris)* will stand extremes of cold and drought and does not require a rich soil. The foliage is its most interesting and beautiful characteristic. The dense short hairs which cover the palmately-lobed leaves give a velvety texture; the leaves are almost white on the under side. As they unfold slowly from tight pleats, the three-to-four-inch broad leaves hold the morning dew; at any time of day in the hottest summer weather, shining beads of moisture glisten in the folds of ladys-mantle. Perhaps the common name was derived from the stylish tailoring of the leaves or from the protective coating that makes them nature's example of waterproof material.

When the little airy yellow blossoms on angular stems appear in June, the plant looks like a modern flower arrangement held firmly in place by the artistic rosette of basal leaves. The "mossie flowers clustering thick together of a yellowish greene colour," as Gerard described them, lack petals and yet are counted among the members of the rose family by taxonomists. They have a slight perfume but not enough to attract many insects. The sprays dry well and make appealing material for winter bouquets. No description of ladys-mantle can do justice to its real appeal to the eye.

It was originally cultivated for its success in stopping bleeding and reducing bruises, and for other remarkable effects whether the leaves were applied outwardly or a decoction of the herb was taken. Nicholas Culpeper, seventeenth-century herbalist, adds this startling bit of information to his praise of it as a singular wound herb, "it is very proper for . . . such women or maids as have over great flagging breasts, causing them to grow less and hard, being both drank and outwardly applied. . . " There are quite a few advantages to a plant which will grow in full sun or part shade, needs no winter covering or special feeding, and offers its own beauty and a beauty treatment, too.

Parsley piert, *Alchemilla arvensis*, is a close cousin of ladys-mantle, which I hope to grow sometime just for its curious name. Neither plant nor seed is available in this country. Parsley piert is smaller than *Alchemilla vulgaris*, with very small three-cleft leaves. Culpeper describes the flowers as "so small they can hardly be seen, and the seed as small as may be." The name is believed to be a corruption of parsley pierce-stone, because the herbalists found it effective in breaking up stones in the bladder. This herb has no relation to parsley (*Petrosetinum crispum*).

Culpeper has this to say about parsley piert: "Its operation is very prevalent to provoke urine, and to break the stone. It is a very good salad herb. It were good the gentry would pickle it up as they pickle up samphire for their use all winter. I cannot teach them how to do it: yet this I can tell them, it is a very wholesome herb. They may also keep the herb dry or in a syrup if they please. . . ."

RHODODENDRON DISCOVERIES (from page 100)

flowered *R. delavayi* represents the Arboreum Series in both Thailand and Indochina and that the Fortunei Series extends southward and eastward into Thailand with the discovery there of *R. serotinum.* This species, which was thought to bloom in September, is described as blooming in April. Some species in the Fortunei Series are useful in the gardens of the northeastern United States.

Rhododendrons of the spectacular yellow-flowered Lacteum Series, greatly valued in Great Britain and on the West Coast of the United States, are found in Viet Nam. Species of the Stamineum Series occur in an immense area that embraces Burma, southern China, Formosa, Indochina, and Thailand. Even a species of the primitive large-leaved Falconeri Series inhabits North Viet Nam. The persistent-leaved azaleas of the Obtusum Subseries (subgenus *Anthodendron,* section Tsutsusi, in Dr. Sleumer's treatment), familiar to gardeners as "Japanese azaleas," occur in Thailand, Laos, Viet Nam, and in the Philippines.

It is apparent for the first time that there is a gigantic overlap in the distribution of rhododendrons from their two evolutionary cradles on continental Asia and in Malaysia, and that their geographical and taxonomic relationships are different from those that we had supposed.

Dr. Sleumer has followed this revelation with the publication recently of *The Genus Rhododendron in Malaysia** in which, for the first time, the so-called Javanicum rhododendrons, primarily from Indonesia and New Guinea, and the group that we now know as the Vaccinioides Series are gathered into an orderly and logical classification under section Vireya. This monumental work provides a systematic identification of the Malaysian rhododendrons, encompassing 261 species and 55 varieties and forms, of which 96 species and 29 varieties are newly described from recent collections by members of the Archbold Expedition, by the Dutch expeditions, and by others in New Guinea, and by Eyma in the central Celebes.

It would scarcely be possible to exaggerate the significance of Dr. Sleumer's work to those with a special interest in rhododendrons. Until the present time, more than a quarter of the known species in the genus have been lost in limbo, their relationships unknown, and the whole group divorced from the remaining three-quarters of the species that inhabit the earth. Now, at last, we have an ordered identification of the Indonesian and New Guinea species in a system that encompasses all of the world's known rhododendrons. Their relationships are clarified, and the whole genus shifts into new perspective in distribution, taxonomy, and phylogeny.

For the first time we can say that there are about nine hundred and twenty-five known species of *Rhododendron* in existence, and we can assign each to its proper place in a botanical classification. A taxonomic accomplishment of the first order has been unveiled, and all rhododendron enthusiasts will welcome the enlightenment that accompanies it.

GARDEN IN THE FOREST (from page 92)

meaningful religious service under the direction of Dr. A. C. Voran.

The Foundation

In April, 1960, the Gardens were legally transferred to the A. J. and Nona Trigg Hodges Foundation.

The creation of the Gardens was the dream and achievement of A. J. Hodges and the late Mrs. Nona Trigg

Hodges, who devoted some eight years to this labor of love. Mrs. Hodges' death just shortly before the formal dedication of the project in May, 1959, set in motion the transfer of the Gardens to a non-profit foundation which had been planned by the owners for some time. Mr. Hodges, as a trustee, directs the affairs of the Gardens, now the property of the Foundation. Other trustees are Dr. J. J. Mickle, President of Centenary College, Shreveport, Louisiana, and Eugene McElvaney, Senior Vice President of The First National Bank in Dallas, Texas.

It is the desire of the founders that the formation of the Foundation will enable the continued maintenance and operation of the Gardens. Judging from the attendance over the past two years, the Gardens should be self-sustaining by 1962.

Historic Heritage

The natural scenic area of Hodges Gardens is reminiscent of the primeval forest that existed centuries before the white man strode into this area—a reminder of the impressions of early explorers who came this way, Cabeza de Vaca, Moscosco, Tonto-The-Iron-Hand, Iberville, and Bienville, all of whom paid glowing tribute to the natural beauty of the land.

Other sites in west Louisiana remind us of past eras—Los Adias, a mission built by Spanish missionaries in 1717; plantation homes on the Cane near Natchitoches; Fort Jesup where famous American generals protected American settlers; The Battle Park Museum at Mansfield, Louisiana, with its relics and memorabilia of Civil War days. As thousands come to see these relics of the past and to enjoy the beauty of flowers and trees, we know history's wheel has turned full circle in The Land of El Camino Real.

ROSE DAY

at The New York Botanical Garden

June 13, 1961

Plans for the nineteenth annual Rose Day at The New York Botanical Garden call for guided tours by experts who know their roses and can evaluate the relative merits of the modern varieties.

The tours are scheduled to start in the Rose Garden at 10 a.m., 11 a.m., 2 p.m., and 3 p.m.

The tractor train, *the Floral Flyer*, will be stationed at the Main Gate to transport visitors to the Rose Garden.

As the rehabilitation of the Museum and Administration Building is taking longer than anticipated, it is not possible to hold the usual afternoon program in the Lecture Hall.

All back issues and reprints of back issues of *Addisonia, Brittonia, Economic Botany, Memoirs of The New York Botanical Garden, Mycologia, and North American Flora* are handled exclusively by Stechert-Hafner, 31 East 10th St., New York 3, N. Y. All inquiries should be addressed to that company.

Stechert-Hafner also sells the following books published for The New York Botanical Garden at these list prices:

Britton: *Flora of Bermuda*		$10.00
Britton and Millspaugh: *The Bahama Flora*		9.50
Gleason: *Plants of the Vicinity of New York*		3.00
Gleason and Collaborators: *The New Britton and Brown Illustrated Flora of the Northeastern United States and Adjacent Canada**	3 vols.	35.00
*Family Keys from New Britton and Brown Flora**		1.00
Hagelstein: *The Mycetozoa*		7.50
Mackenzie: *North American Cariceae*	2 vols.	20.00
Keys to the North American Species of Carex	Price on request	
Rydberg: *Flora of the Prairies and Plains of Central America*		8.50
Van Melle: *Review of Juniperus Chinensis et al*		1.50

*This work may also be purchased from The New York Botanical Garden. There is a handling charge of $1.00 on The New Britton and Brown Flora.

Subscriptions to the following periodicals should be sent to The New York Botanical Garden.

Addisonia, colored plates of flowering plants accompanied by non-technical descriptions; 8 plates to a part, 4 parts to a volume. Published one part annually. Free to members of the Garden; $10.00 per volume to others.

Brittonia, published quarterly for the American Society of Plant Taxonomists. Subscription included in the Society's dues $6.50 a year. $7.50 per volume to others.

Economic Botany, official organ of the Society of Economic Botany, published quarterly. Members' subscription included in Society's dues $7.50 a year. Subscription to non-members $8.00 a year.

Memoirs of The New York Botanical Garden, scientific papers by members of the staff and collaborators; issued irregularly. Vol. 10, $10.00. Prices of earlier volumes on request.

Mycologia, official organ of the Mycological Society of America, published bi-monthly. Members' subscription included in Society's dues $8.00 a year. Subscription to non-members $8.50 a year.

North American Flora, descriptions of the wild plants of North America, including Greenland, the West Indies, and Central America. 100 parts issued; now in 2nd series. Prices of parts on request.

The Garden Journal, non-technical articles on botanical, horticultural, and kindred subjects, published bi-monthly. Free to members of the Garden. Subscription $3.00 a year (foreign $3.50) to others.

Back issues of The Garden Journal, 75¢ each, and of The Journal of The New York Botanical Garden, 50¢ each, are available from The Garden.

THE NEW YORK BOTANICAL GARDEN
BRONX PARK NEW YORK 58, N. Y.

The Library of The New York Botanical Garden

At a meeting on January 31, 1961, of the Women's Council of The New York Public Library, Mrs. John E. Parsons spoke on The New York Botanical Garden; Mrs. John Nicholas Brown on the John Carter Brown Library in Providence, Rhode Island; Mrs. John G. McCarthy on the American Library in Paris; Mrs. John De Witt Peltz on the London Library on St. James' Square, London; and Mrs. Arnold Whitridge on the Gennadeion Library in Athens. Mrs. Parsons is the Chairman of the Advisory Council of The New York Botanical Garden.

Mrs. Parsons' talk follows:

A botanical garden, as distinguished from a private garden such as yours and mine, has three distinct entities. Like ours, it has the outdoor and indoor plantings, though on a majestic scale. Unlike ours, it needs an herbarium and, above all, a very large library to be effective. An herbarium is a collection of dried and mounted specimens of plants, invaluable for record and further identification, and presenting many custodial problems.

However, it is of The New York Botanical Garden Library that I would speak this morning. It ranks among the three foremost research collections of botanical and horticultural books in the Western Hemisphere. The other two of like quality are at Harvard University and at the United States Department of Agriculture in Washington, D. C., though neither perhaps is as compactly housed as ours under one roof.

Its founding was rather late. In 1896, the Trustees of Columbia University agreed to deposit with The New York Botanical Garden, upon request and on loan, their entire botanical library of some five thousand bound volumes. These, added to the twenty-five hundred books already on hand, made a substantial nest-egg. The loan of the five thousand volumes from Columbia is an indefinite one by agreement and not, as is some times the sad case between friends, a casual one. Many Columbia students, doing their graduate work in botany, are expected to study at the Garden's Library.

Later, choice and small collections were attracted here as by a magnet. For instance, Dr. David Hosack's botanical books were acquired sixty years ago through the New York Academy of Medicine which, even at that date, described them as "rare, and difficult to obtain."

Yet the backbone of the Library lay rather in purchases than in gifts or loans. In 1910 Dr. John Henry Barnhart, the first bibliographer, made notable acquisitions abroad. In 1923, several libraries were consolidated at the Botanical Garden in Geneva, Switzerland, and The New York Botanical Garden had the means, at that moment, to buy many of the duplicates.

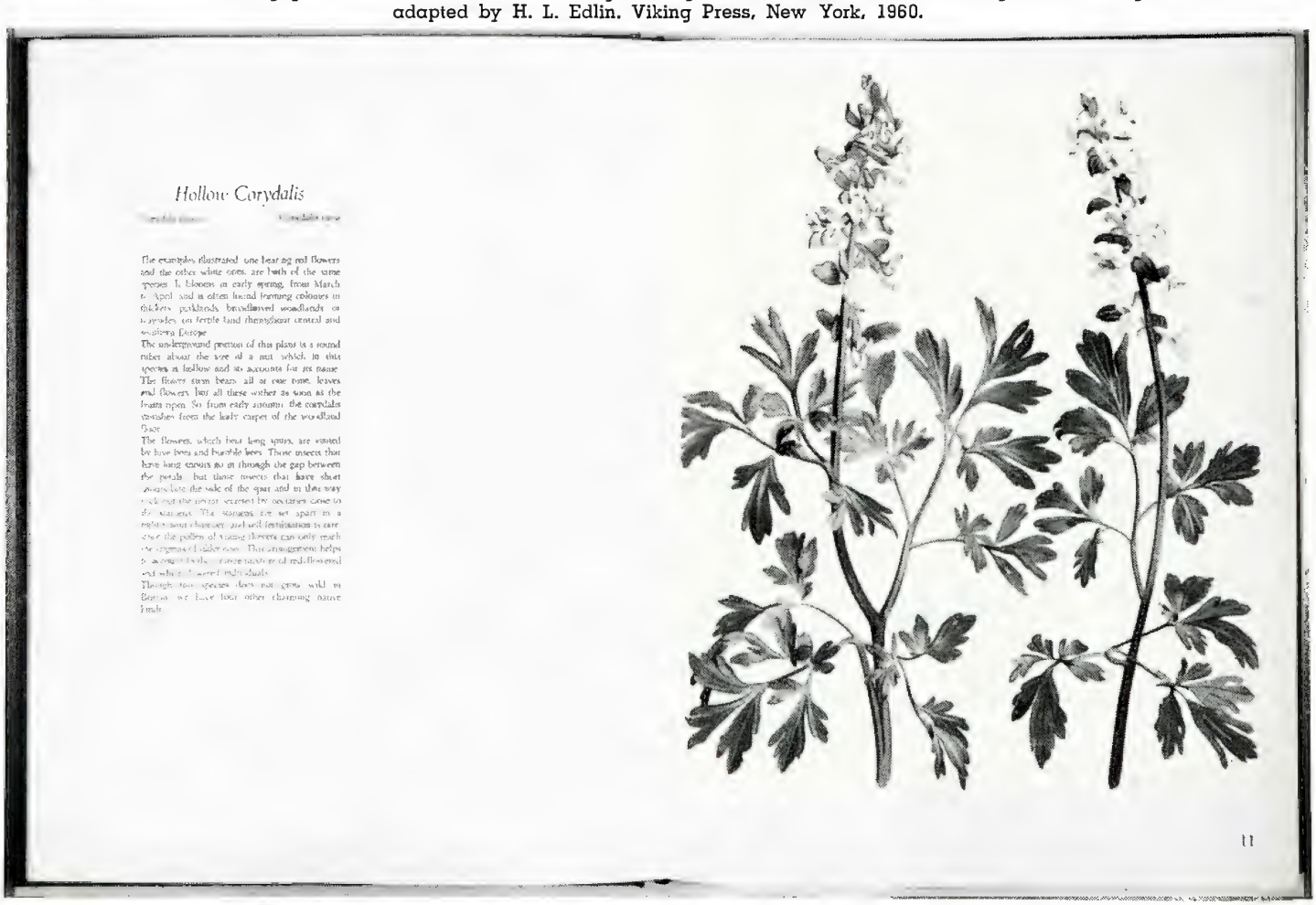
Today the bound volumes number over sixty-five thousand and the unbound pieces three hundred thousand or more. They have been housed, up to the present time, under the dome of a building that only Mr. Steinberg could have invented. I personally love such architecture. In all honesty it must be declared treacherously airy and even rainy. So the Board of Managers and the City plan a new and appropriate wing to house the Library. The domed building is to remain for many other uses. The substantial new library wing will grow at the back, where dust and damp cannot corrupt (what with the air-conditioning), nor the Steinbergian architecture be spoiled. Hopefully, we shall break ground this autumn.

What sort of books comprise a botanical library? The treasures are, largely, the herbals. An herbal is quite simply "a treatise on herbs or plants," though for earlier times, say prior to 1700, it usually meant medicinal herbs and how to use them for your health. Six of these, printed before 1500, fall into that lovely category called incunabula. Manuscript letters are valued, too; for example, those that John Torrey received from leading botanists in the mid-eighteen hundreds. Finest in this country are the books by and relating to Darwin and Linnaeus.

Illustrated Flora, both British and French, are among the handsomest treasures. A few of these have been selected and brought here today for you to see by Elizabeth C. Hall, who is the Sarah Gildersleeve Fife Research Librarian at the Garden. The staff, in addition to Miss Hall, consists of Dr. Harold William Rickett, Bibliographer, and the Administrative Librarian James J. Daly, and three assistants.

Among the books in constant use are Pritzel's *Thesaurus of Botanical Literature*. With German thoroughness this was published in Leipzig in

From *Flowers in Color*—sixty plates in ten colors after the originals by Hans Schwarzenbach. Text by Prof. W. Rytz, translated and adapted by H. L. Edlin. Viking Press, New York, 1960.



DISSERTATION
SUR LES ROSES,
LEURS PROPRIETÉS MEDECINALES ET ECONOMIQUES,
ET SUR LES ANECDOTES CONCERNANT CE GENRE DE PLANTES

From *Nouveau Traité . . . De Toutes Les Plantes,* Vol. I, by Pierre Joseph Buchoz, Paris, 1787.

1872. The Royal Horticultural Society's *Index Londinensis to Illustrations* is another important "reference tool."

A complete file of United States Plant Patents (there are now 2,011 of these) is often consulted, as well as the picture collection of about fifty thousand. Also very useful indeed are the seed and nursery catalogues from the eighteenth century to date.

Exchanges provide a web of information and good-will around the world. *The Garden Journal,* for instance, is exchanged for similar journals from Fiji, South Africa, Madagascar, and Jamaica, to mention only four out of hundreds.

Who uses a botanical and horticultural library? There were six thousand reference problems during 1958. Questions came from botanists and biologists, graduate students, college teachers, and visiting investigators, from City, State and Federal Agencies; from magazine publishers, movie directors, from those who edit encyclopedias and those who draw, paint, write, or advertise, to name only a few. Hardly a day goes by that a letter of inquiry does not come from drug companies—from Squibb or Ciba or Merck—or from one of the large wholesale perfume houses.

A large number of users were amateur botanists and gardeners, florists, and nurserymen.

Telephoned questions alone ran to 2,597 calls last year. What sort of questions are asked? Here are a few:

"At what period do the principal hayfever plants flower? Where can I go to escape them?"

"Does 'the man-eating tree of Madagascar' really exist?"

"What plant is the true shamrock?"

I am sure you will be happy to know that New York City's Health Department has a section called "New York City Poison Control." They frequently consult the Garden's Library. Itching powder is sold illegally in shops that specialize in "jokes." "What is the main ingredient of itching powder?" City Poison Control wanted to know.

"What flowers are protected by law in New York State?"

A group said, "We are laying out a church garden. What Bible plants can we grow, and where can we buy them?"

All these questions were answered, except the one about the shamrock, which is controversial as are so many lovely Irish things.

I hope you will all visit the Library of The New York Botanical Garden. It is there for your use, and a most hearty welcome to every one of you.

FANNY WICKES PARSONS

REVIEWS OF RECENT BOTANICAL BOOKS

THE GEOLOGICAL EVOLUTION OF NORTH AMERICA (A regional approach to Historical Geology). Clark, Thomas H. and Colin W. Stearn. vi and 434 pages, illustrations, indexed. The Ronald Press Co., New York. 1960. $7.50

Books of this nature are traditionally entitled "Historical Geology" The authors, both professors at McGill University, Montreal, Canada, succeeded in breaking through the time-worn college-text facade to present a refreshing approach to the origin of our landscape and its life. Since research in historical geology is tedious, and the results are slow in their acceptance and incorporation in standard texts, the drastically revitalized approach in this well-illustrated work should go far to stimulate prospective students.

The five principal parts are subdivided into chapters of fundamental importance for North America, omitting excessive detail common to former texts, material that should be reserved for advanced study in stratigraphy and evolution. The introductory chapters on the earth

BOOKLETS

Catalog of Hardy Trees and Shrubs, a list of the woody plants grown outdoors at the Garden in 1942. Illus. Price 75¢ per copy.

Hardy Ferns and Their Culture. Illus. Price 25¢ per copy.

Flora of the Unicorn Tapestries. Illus. Price 25¢ per copy.

Food and Drug Plants of the North American Indians. Price 25¢ per copy.

Montgomery Conifer Collection, non-technical descriptions of conifers with information on history, habitat, and usage. Illus. Price 50¢ per copy.

Plants of the Holy Scriptures. Price 25¢ per copy.

Succulent Plants of New and Old World Deserts. Illus. Price 50¢ per copy.

Vegetables and Fruits for the Home Garden. Price 25¢ per copy.

Also reprints of well-illustrated, step-by-step articles on different garden techniques, written and photographed by T. H. Everett, Assistant Director (Horticulture): "Lawn Verges," "How to Force Dutch Bulbs" (in the home), "Some Sources of Humus," "Tree Pruning Pointers," "Sowing Seeds in Flats," "How to Transplant," "Some Fall Gardening Work" (i.e. heeling in, root cuttings, bulbs in pebbles), "Winter Protection of Plants."

10¢ each — any 6 reprints 50¢

The above booklets and reprints are obtainable from The New York Botanical Garden

THE NEW YORK BOTANICAL GARDEN

BRONX PARK NEW YORK 58, N. Y.

in the universe, the geosynclinal theory, and epeiric seas of the stable interior incorporate findings of the latest research in these fields. A thorough evolution of the Appalachian and Cordilleran geosynclines is developed, showing that these features have structurally and physiographically dominated the continent since early Paleozoic history. A fine section on the Canadian shield or the continental nucleus, the Arctic islands, and the ice age is particularly timely in view of the recent surge of Arctic exploration. A separate section devotes considerable space to the evolution of plant and animal life with an understandable stress on ancient fauna, and the history of man. The accepted evolutionary sequence is appended, and a simplified classification of the organic world elucidates the taxonomic question. Selected references acquaint the reader with important basic literature. Excellent illustrations and revealing diagrams reflect recent techniques of aerial photography.

HERMAN F. BECKER

ILLUSTRATED GENERA OF WOOD DECAY FUNGI. Fergus, Charles L. 132 pages, illustrated. Burgess Publishing Company, Minneapolis, Minnesota. 1960. $4.00

This manual provides an excellent aid for the identification of fungi that cause decay of slash, timber, and wood. Identification is accomplished by use of well-written keys to ten families and eighty-five genera of wood decaying fungi, eighty-one of which are illustrated with a photograph of a specimen of a representative species. Descriptions are presented for each genus; and for some of the more important genera, keys to species are included. The non-technical language of the keys and descriptions and the good black and white photographs and diagrammatic drawings make the manual a handy tool for the forester, naturalist, and student who need to identify both the harmful and beneficial fungi associated with wood and slash decay. A brief introduction, explanation of the keys, and directions for collection of wood decaying fungi are included.

CLARK T. ROGERSON

WEED CONTROL HANDBOOK. Woodward, E. K., Ed. Second Edition. 264 pages, illustrated, indexed. Blackwell Scientific Publications, Ltd., Oxford. 1960. $4.50

The rapid advances in chemical control of weeds makes any book on this subject out-of-date in a relatively short while; the present volume appeared only two years after the first edition. This highly technical book is not for amateur gardeners, but for manufacturers of weed-controlling chemicals, and for research and regulatory workers in the field. Many of the chemicals mentioned and the weeds controlled by them are found chiefly in the British Isles.

P. P. PIRONE

PLANT LIFE OF WEST VIRGINIA. Core, Earl L. 224 pages, illustrated, indexed. Scholar's Library, New York. 1960. $6.00

This is "an attempt to provide for the average citizen a survey of the salient features of the plant life of West Virginia." It includes, among other things, line drawings of many common plants of the state, from green algae to composites. It should appeal especially to those who have been exposed to some of the basic botanical concepts and terminology but who are not professional botanists.

ARTHUR CRONQUIST

FOREST AND SHADE TREE ENTOMOLOGY. Anderson, Roger F. 428 pages, illustrated, indexed. John Wiley and Sons, Inc., New York. 1960. $8.50

This is an excellent, well-planned book that combines basic entomology with the life cycle of and control measures for specific insects. Especially useful to student entomologists are keys to identification of the more common pests. Instructors will like the large number of selected references after each chapter, or after specific insects.

The major part of the book covers the following important groups: foliage-eating insects, inner-bark borers, wood borers, sapsucking insects, twig-, bud-, and seedling-damaging insects, root-infesting insects, and cone and seed borers. Although primarily a book on forest entomology, commercial arborists, nurserymen, shade-tree superintendents, and other tree-maintenance workers will find valuable information in its pages.

P. P. PIRONE

ADVENTURES IN ECOLOGY. Clements, Edith S. 244 pages, illustrated. Pageant Press, Inc., New York. 1960. $5.00

Mrs. Clements in a delightfully informal style faithfully presents a detailed account of early forays in the United States, undertaken as companion and assistant to her scientist husband Dr. Frederic E. Clements—forays which made ecological history. Excellent photography aptly illustrate the principles of ecology and occasional pen and ink sketches amusingly point up the hazards of field tripping in those decades, whether by burro or Buick. It is to be regretted that a better grade of stock was not used from the standpoint of both photographs and text.

Events leading to the founding of the pioneer Alpine Laboratory on Pike's Peak, Colorado, are chronicled, and Dr. Clements' deductive methods of teaching are heavily underscored. The person who encounters ecology for the first time in these pages will ever after be more aware of the impact of environment on plant life. One closes the book with the feeling that, in addition to being pleasantly informed, it has been a privilege to have had a glimpse into the lives of two very fine people, both dedicated to an ideal—ecology.

CAROLINE K. ALLEN

TREES, SHRUBS AND WOODY VINES OF THE SOUTHWEST. Vines, Robert A. 1104 pages, illustrated, indexed, glossary, bibliography. University of Texas Press, Austin, Texas. 1960. $25.00

This is a massive, six-pound tome treating the woody plants of Texas, New Mexico, Oklahoma, Arkansas, and Louisiana. Each of more than twelve hundred species is fully described and attractively illustrated. The sequence of families in Englerian; the arrangement within the families is alphabetical. There are no keys. The author tends to follow authoritative opinion, rather than attempting an independent taxonomic evaluation of critical groups. The book should be useful to foresters, conservationists, county agents, and amateur botanists.

ARTHUR CRONQUIST

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THE BIOLOGY OF WEEDS. Harper, John L., Ed. 256 pages, illustrated. Charles C. Thomas, Springfield, Illinois. 1960. $9.75

This book consists of a series of separate, individually interesting scientific papers which have in common only the fact that they deal with weeds. There is something for everybody, including taxonomists, ecologists, physiologists, evolutionary theorists, and those concerned with practical problems of weed control.

ARTHUR CRONQUIST

ILLUSTRATED GENERA OF IMPERFECT FUNGI. Barnett, H. L. Second edition. 225 pages, illustrated. Burgess Publishing Company, Minneapolis, Minnesota. 1960. $4.50

This manual, first published in 1955, has been expanded to include 462 genera of the imperfect fungi, a fifty per cent increase over the previous edition. For each genus a brief description and diagrammatic drawing of a representative species are given. Also included are an extensive key to the genera, an adequate list of references, and an index to genera. The keys are well-written, the descriptions are concise, and the diagrammatic drawings are helpful aids to identification. The manual is intended primarily for the student who wishes to identify the common imperfect fungi that are of so much economic importance in agriculture, industry, and medicine.

CLARK T. ROGERSON

MICROBIOLOGY. HISTORICAL CONTRIBUTIONS FROM 1776 TO 1908. R. N. Doetsch, Ed. xii + 233 pages, illustrated. Rutgers University Press, New Brunswick, New Jersey. 1960. $5.00

Professor Doetsch collected English translations of some of the significant publications in the history of bacteriology (not, as his title suggestions, of microbiology) from Spallanzini to E. F. Smith. He has prefaced each paper with an elementary biography of the author. If it is assumed that merely reading the papers of great scientists is a salutory method of teaching science, this book has some merit.

RICHARD M. KLEIN

ATLAS OF BACTERIAL FLAGELLATION. Leifson, Einar. 171 pages, illustrated, indexed. Academic Press Inc., New York. 1960. $7.00

Flagellation is a major basis for identification and classification of bacteria. The Atlas covers the shape and arrangement of the flagella on representative strains of all available species. Good photomicrographs illustrate normal and mutational flagellar shapes and arrangements.

The first four chapters deal briefly with cytological techniques, terminology describing the arrangements of flagella, variation and mutation of flagellar shape, and bacterial evolution with respect to flagellation.

It would be most welcome if future revisions of the Atlas would include a chapter on the ultrastructure of flagella and electromicrographs, and photomicrographic enlargements were specified in the legends. ELSA H. J. O'DONNELL

BRIEF NOTES ON RECENT BOOKS

By ELIZABETH C. HALL

Miss Hall is Sarah Gildersleeve Fife Research Librarian of The New York Botanical Garden.

ART, FLOWER ARRANGEMENTS AND HOLIDAYS

THE CHRISTMAS TREE; AN EVERGREEN GARLAND FILLED WITH HISTORY, FOLKLORE, SYMBOLISM, TRADITIONS, LEGENDS AND STORIES. Foley, Daniel J. 159 pages, illustrated, part colored, bibliography, indexed. Chilton Co., Philadelphia, Pa. 1960. $3.50

The title of this book describes the contents —a veritable Christmas encyclopedia with fascinating illustrations, old and new. Painstaking research was necessary to produce such a comprehensive, useful, and attractive volume.

CHRYSANTHEMUMS INDOORS. Bayles, Vera T. 92 pages, illustrated, indexed. Hearthside Press, New York, 1960. $3.50

Primarily devoted to chrysanthemums in flower arrangements, corsages, potted plants for ornament and flower show exhibits; brief notes on Bonsai and Cascade culture.

DECORATIVE ALPHABETS AND INITIALS. Nesbitt, Alexander, ed. unpaged, illustrated, bibliography. Dover Publications, New York, N. Y. 1960. $2.25

Ornamental letters selected from ancient manuscripts and rare books, with historical notes. Dr. Nesbitt is Associate Professor at the Rhode Island School of Design.

DRIFTWOOD IN THE HOME. Schaffer, Florence M. 128 pages, illustrated, indexed. Hearthside Press, New York. 1960. $3.95

Since 1957, when Mrs. Shaffer's *ABC of Driftwood for Flower Arrangers* was published, there has been an increasing interest in decorating with "driftwood" objects. The term "driftwood" is now applied to numerous types of wood which has been weathered by sun, wind, rain, ocean wave, tornado, and sand storm. In the present book there are extensive notes on treating and finishing different kinds of wood and detailed discussion of each of the one hundred and ten arrangements illustrated by photographs.

HANDBOOK OF PLANT AND FLORAL ORNAMENT SELECTED FROM THE HERBALS OF THE SIXTEENTH CENTURY. . . Hatton, Richard G. 539 pages, illustrated, indexed. Dover Publications, New York. 1960. $2.98

An unabridged republication of the formerly titled *The Craftsman's Plant-Book; or Figures of Plants*, originally published in 1909. A remarkable collection of over twelve hundred plant drawings arranged according to plant families. Informative text on the use of plant form in design.

HOLIDAY AND PARTY TABLE SETTINGS. Schulke, Zelda W. 121 pages, illustrated, part colored, indexed. Hearthside Press, New York, N. Y. 1960. $4.50

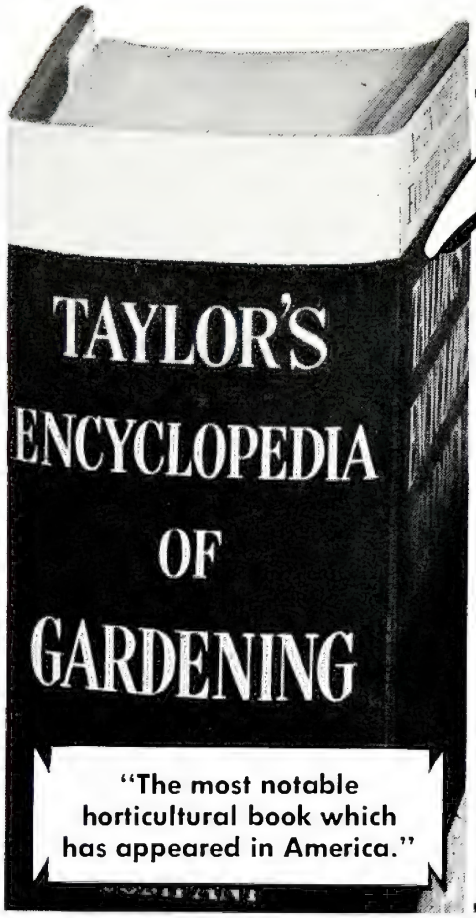
Suggestions for all sorts of occasions—holidays, anniversaries, bon voyage parties, buffets, and indoor and outdoor settings. Many clever ideas.

THE NEW CHRISTMAS MAKE-IT BOOK. Baer, Barbara. 96 pages, illustrated. Hearthside Press, New York, N. Y. 1960. $2.95

Hundreds of suggestions---drying of roadside and garden flowers for winter arrangements and for Christmas cards, making terarriums and miniature gardens, and so on.

SIMPLIFIED FLOWER ARRANGEMENTS. Roberts, Patricia E. 134 pages, illustrated, part colored. Viking Press, New York, N. Y. 1960. $5.00

Mrs. Roberts, formerly associated with the Constance Spry Shop in New York City, gives instructions in the mechanics and techniques of making over fifty arrangements which she has illustrated with photographs. A flower chart, tabulating color, shape, size, and seasonal availability in the garden and florist's shop is a handy feature.



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2 Park Street, Boston 7, Mass.

THE STYLES OF ORNAMENT. Speltz, Alexander. 647 pages, illustrated, bibliography, indexed. Dover Publications, New York, N. Y. 1960. $2.25

3,765 illustrations of ornamental designs arranged in chronological sequence from prehistoric times to the early nineteenth century. Of particular interest to the botanically minded are the sections on Egyptian art with figures of the palm tree and papyrus; Gothic flora with conventionalized figures of arum, lily, bellflower, parsley, fig, maple, and grape; the lotus in Indian design; and the stylized tulips in the wall tiles of Delft.

Conservation And Miscellaneous Writings

THE BALANCE OF NATURE. Milne, Lorus J. and Margery Milne. 329 pages, illustrated, bibliography, indexed. Alfred A. Knopf, New York, N. Y. 1960. $5.00

A most revealing account of the increase and decrease of animal and plant populations brought about by destructive and constructive man, and written in a vivid, readable style.

NATURE AND MAN. Hillaby, John. 64 pages, illustrated, bibliography, indexed. Roy Publishers, New York, N. Y. 1960. $2.95

Mr. Hillaby is a Yorkshireman, a naturalist, and a European correspondent of *The New York Times*. Through his extensive travels in many countries of the world, he has become aware of the tremendous struggle among man, animals, and plants. This little book offers a great deal in ecology, conservation, botany, and zoology.

THE SEPARATION OF THE FARM BUREAU AND THE EXTENSION SERVICE; POLITICAL ISSUE IN A FEDERAL SYSTEM. Block, William J. (Illinois Studies in the Social Sciences: vol. 47) 304 pages, bibliography, indexed. University of Illinois press, Urbana, Ill. 1960. paper: $4.00; cloth: $5.00

A study of the conflict covering the period from 1939 to the present, well-documented.

SERVE BY CONSERVING; THE WORLD PROBLEM OF CONSERVATION. Cox, Jack, comp. 157 pages, illustrated. International Publications Service, New York, N. Y. 1959. $3.25

An international view of conservation with special emphasis on the ways and means in which Boy Scouts can and are helping to conserve wild-life and natural resources. Mr. Cox, who is Assistant County Commissioner (Boy Scouts) of London was commissioned by The Boy Scouts' International Bureau to compile this very informative manual.

THIS IS THE AMERICAN EARTH. Adams, Ansel and Nancy Newhall. 89 pages, illustrated. Alfred Knopf, New York, N. Y. 1960. $15.00

Magnificent photographs of our country out-of-doors, mostly by Ansel Adams, with poetic-prose text by Nancy Newhall. A fervent plea to conserve these scenic treasures. We are indebted for publishing this superb work to the Sierra Club, founded by John Muir in 1892.

For Young Readers

SACAJAWEA; GUIDE TO LEWIS AND CLARK. Seibert, Jerry. 192 pages, illustrated, Houghton Mifflin Co., Boston, Mass. 1960. $1.95

Boys and girls who like adventure stories will enjoy this exciting account of the Shoshoni girl guide who accompanied the explorers, Lewis and Clark, on their journey over the Rockies to the Pacific Coast.

SCIENCE ON THE SHORES AND BANKS. Cooper, Elizabeth K. 187 pages, illustrated, indexed. Harcourt, Brace and Co., New York, N. Y. 1960. $3.25

Mrs. Cooper's previous book, *Science in Your Own Back Yard"* won the Thomas Alva Edison Foundation Award as the best science book for children published in 1958.

SEEDS ARE WONDERFUL. Foster, Willene K. and Pearl Queree. 32 pages, illustrated. Carl J. Leibel, Puente, Cal. 1960. $2.50

Easy reading about seeds with plenty of pictures.

SMALL PETS FROM WOODS AND FIELDS. Buck, Margaret Waring. 72 pages, illustrated, bibliography, indexed. Abingdon Press, New York, N. Y. 1960. paper: $1.75; cloth: $3.00

Here are the answers to the young naturalist's questions: how to make terrariums, vivariums, cages; how to catch and hold and feed insects, birds, small mammals, toads, frogs. Exceptionally well illustrated by the author.

SO YOU WANT TO BE A SCIENTIST. Nourse, Alan E. 182 pages, illustrated, indexed. Harper and Bros., New York, N. Y. 1960. $3.00

A useful vocational guide with emphasis on biology, mathematics, chemistry, and physics. By the author of *So You Want To Be a Doctor* and *So You Want to Be a Lawyer*.

A TREE IS A PLANT. Bulla, Clyde Robert. unpaged, illustrated, part colored. Thomas Y. Crowell Co., New York, N. Y. 1960. $1.95

A picture story of the life of an apple tree, for the little tot.

THE TRUE BOOK OF PLANT EXPERIMENTS. Podendorf, Illa. 48 pages, colored illustrations. Children's Press, Chicago, Ill. 1960. $2.00

Simple things to do at home such as: the game of Touch-and-Tell, sowing seeds on blotting paper, growing a sweet potato vine, planting a terrarium, and making spore prints. Ages seven to nine.

WATER FOR THE WORLD. Helfman, Elizabeth S. 213 pages, illustrated, bibliography, indexed. Longmans, Green and Co., New York, N. Y. 1960. $3.75

For those in their early teens, a fascinating account of water in its many aspects from ancient history to the present day. The story involves droughts, floods, primitive and modern irrigation, the manifold uses of water in peace and war, its symbolic meanings in legends and rituals, and finally, the vital importance of conservation.

(Continued on Inside Back Cover)

NEWS, NOTES and COMMENTS

Recent activities of the Director and Staff. Dr. William C. Steere, Director, attended meetings of the Council for the Advancement of Science Writing, at Princeton, N. J., a meeting of the Commissioner of Education's Committee on Museum Resources in Albany, N. Y., the luncheon of the Garden Club of America during the week of the International Flower Show, and the Awards Dinner of the Garden Club of America.

T. H. Everett, Assistant Director (Horticulture) and Senior Curator of Education, gave a talk before the Federated Garden Clubs of New York State, Inc., held in the Metropolitan Museum of Art in New York; was guest speaker at the annual dinner of the American Dahlia Society, held in New York; and addressed the Staten Island Institute of Arts and Sciences, which is establishing an arboretum at Wagner College on the Island.

Dr. Harold Rickett, Bibliographer and Senior Curator of the Library, concluded the Downtown Lecture Series, sponsored by the Volunteer Associates of The New York Botanical Garden, with his illustrated talk on "Inside Flowers." He spent a week in research at the United States National Herbarium, Smithsonian Institute, Washington, D. C.

Dr. Bassett Maguire, Head Curator and Coordinator of Tropical Botany, will leave shortly for a four to six-week collecting trip in the southern part of the Pakaraima Mountains in British Guiana on the borderline of Brazil. Another expedition will work in and around Amapó, Brazil. There will be two areas of operation; one with Dr. Murça Pires, Chief of the Botanical Section at the Instituto Agronômico do Norte, and the other with Dr. Walter Egler, Director of the Museu Goeldi. Dr. Howard Irwin, Research Associate, will lead this expedition; it will start from the Garden the last week in June.

Dr. P. P. Pirone, Senior Plant Pathologist, talked about dormant spraying on Ruth Alampi's program, "Around the House and Garden," on NBC. A tree has been named after Dr. Pirone— *Fraxinus excelsior* 'Doctor Pirone'. Developed by Edward H. Scanlon and Associates of Olmstead Falls, Ohio. It is an outstanding street tree with strong upsweeping branches and glossy foliage. It will grow thirty-five feet tall.

An account of Dr. Pirone, with his photograph, appears in *Leaders in American Science*, fourth edition.

Dr. Arthur Cronquist, Curator, spent considerable time during January, February, and March in the Gray and Arnold Arboretum Herbariums of Harvard University, pursuing his research on the intermountain flora.

Dr. Clarke T. Rogerson, Curator of Cryptogamic Botany, attended the conference on Medical Mycology at the New York Academy of Medicine in New York on March 16-17, 1961. Dr. Rickett and Dr. Annette Hervey, Senior Research Associate, also attended the Conference. The banquet honored Dr. Bernard O. Dodge, Dr. Rhodda Benson, and Dr. Joseph Gardner Hopkins.

Dr. Richard M. Klein, Alfred H. Caspary Curator, attended a meeting of the Council of the Society for Cell Biology in New York.

Sister Mary Richardis Schultz, a graduate student from Fordham University, is doing research in Dr. Klein's laboratory to determine why light inhibits the germination of *Phacelia tanacetifolia*. She has received a National Science Foundation grant for an intermediate fellowship.

Dr. Marjorie Anchel, Senior Research Associate, Dr. Nalini N. Valanju, Research Associate, and Dr. Trevor C. McMorris, Research Associate, took the four-day course offered by Perkin Eler Corp., at Norwalk, Connecticut, on the infra-red instrument in Dr. Anchel's laboratory. Dr. Anchel, Dr. Valenju, and Dr. McMorris attended a meeting of the Plant Chemists Society held recently at Columbia University. Dr. McMorris presented a paper on "Investigations on Illudin," which he and Dr. Anchel prepared.

Miss Hall, Sarah Gildersleeve Fife Research Librarian, lectured before the New York Unit of the Herb Society of America on "Herbs I Had Seen While Abroad"; and on "Fragrance in the Garden" before the Garden Club of Teaneck, N. J.

Dorothy Ebel Hansell, Editor of *The Garden Journal*, attended meetings of the Garden Writers Association of America, the International Geranium Society, and the National Association of Gardeners which were held in New York during the week of the International Flower Show.

The Hon. Thomas C. Desmond was among the medal recipients at the Medal Awards Dinner of The Garden Club of America, held at the Colony Club in New York on April 11, 1961. He was presented with the Eloise Payne Luquer Medal for special achievement in the field of botany. Dr. William C. Steere, Director of The New York Botanical Garden, received the medal on behalf of Mr. Desmond, a member of the Garden's Board of Managers. Mr. and Mrs. Desmond had not returned from their cruise around the world.

The National Science Foundation has given a grant of $18,200 to The New York Botanical Garden for the preparation and publication of an international plant index, using punch cards and data processing machines. Sydney W. Gould, Research Associate, is the principal investigator. He will carry on much of his work at the Connecticut Agricultural Station, the co-sponsor of this project. Mr. Gould is an authority on machine tabulations in other fields and will apply the processing methods that he has been working on for ten years, to plant classification. In the past year he prepared thirty-five thousand punched cards in a pilot test of the methods to be used. This test indicated that automatic compilation can be done in a fraction of the time it would take researchers working without machines. The aim of the program is to record some 1,700,000 plant names by genera and species in preparation for their publication by plant families. Cross indexes will make the information useful to researchers in many fields.

The National Science Foundation has awarded a three-year grant of $15,200 to The New York Botanical Garden for investigation on and publication of *Flora Iranica*, that is, the flora of the Iranian Highlands including Persia, Afghanistan, West Pakistan, and the bordering mountain ranges that fall within the territories of Iraq, Palestine, and Soviet Russia. The principal investigator is Prof. Dr. Karl H. Rechinger, who has been in charge of the herbarium of the Natural History Museum in Vienna for more than thirty years. The New York Botanical Garden will support Dr. Rechinger's research through plant specimens and literature, by serving as a central liaison institution with other American institutions, and by serving as admin-

The rock garden, exhibited by The New York Botanical Garden at the International Flower Show, New York, March, 1961, was awarded the gold medal of the Massachusetts Horticultural Society and the New York Florists' Club trophy; also a trophy from the International Flower Show for the best designed pool and waterfall.

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The National Science Foundation has awarded The New York Botanical Garden a grant of $4,000 for the support of "Publication of Part I of *A Manuel of the Leafy Hepaticae of the West Indies, Mexico, Central and South America* by Margaret Fulford, under the direction of Dr. Harold William Rickett, Editor of the Garden's 'Memoirs.'" The one-year grant became effective February 20, 1961.

Dr. William J. Robbins, Director Emeritus of The New York Botanical Garden, was recently presented with the Silver Achievement Medal of the Federated Garden Clubs of New York State, Inc., for his long and distinguished career as a plant physiologist, for the degrees he has attained, the offices he has filled in botanical and scientific societies, the positions he has held at important institutions, and for his many scientific publications.

Visitors to the Garden. The following have visited The New York Botanical Garden during recent months.

Dr. Margarita Silva and
Dr. Elizabeth Haven, College of Physicians and Surgeons, Columbia University, New York, N. Y.
Dr. Gilbert Dallderf, Sloan-Kettering Institute for Cancer Research, New York, N. Y.
Dr. Brenda F. Slade, Botany Dept., Otago University, Dunedin, New Zealand.
Dr. D. Marien and
M. K. Heckt, Biology Dept., Queens College, Flushing, N. Y.
M. Chessin, Botany Dept., Montana State University, Missoula, Mont.
Margarita Hahn Vidal and
Manuel Eduardo Vidal Couce, Buenos Aires, Argentina.
Rev. James L. Harley, S. J., Georgetown University, Washington, D. C.
Dr. George H. M. Lawrence, Director, Rachel McMasters Miller Hunt Botanical Library, Pittsburgh, Pa.
Sir Herbert Howard, Commonwealth Agriculture Bureau, Farnroyal, Bucks., England.
Robert Mann, Lancaster Press, Lancaster, Pa.
Daniel D. Boone, Atlanta, Ga.
Lorna Maitland, London, England.
Dr. Rosa R. de Pirosky, Instituto de Oncologia, Buenos Aires, Argentina.
Harry Wheatcroft, Nottingham, England.
H. C. Greer, London, England.
Dr. Sheila Garratt, Stevens Institute of Technology, Hoboken, N. J.
Dr. George Slate, Agricultural Experiment Station, Geneva, N. Y.
D. Dwidjoseputro, Semerang, Indonesia.
Mrs. A. A. Plagman, Davenport, Iowa.
Dr. Pierre Dansereau, Montreal, Canada.
Norman Taylor, Editor of *Taylor's Encyclopedia of Gardening*, New York, N. Y.
Charles C. Johnson, co-author of *Wildflowers of North America*, New York, N. Y.
Stanley Smith, Curator of Herbarium, New York State Museum, Albany, N. Y.
Dr. Frits Went, Director, Missouri Botanical Garden, St. Louis, Mo.
R. Henry Norweb Jr., Director, Holden Arboretum, Cleveland, Ohio.

Gifts to the Library. The Library of The New York Botanical Garden has been the recipient of these gifts within the past few months: from George Schwartz, *Moments of Discovery*, two volumes, by George Schwartz and W. Bishop, editors, Basic Books, New York, 1958; from *Biological Abstracts* and from the libraries of the New York Zoological Society, the American Museum of Natural History, and Columbia University, books, periodicals, and pamphlets; from V. W. Fletcher, *Orquideas de Venezuela* by G. C. K. Dunsterville, Compania Shell de Venezuela, 1960.

Purchased from the Hoffman Fund in memory of the late Paul Hoffman, Editor of *Suburbia Today: Flowering Stones and Mid-day Flowers* by G. Schwantes, Ernest Benn Ltd., London, 1957; *Darwin, Wallace, and the Theory of Natural Selection*, including the Linnean Society Papers, by Bert James Lowenberg, Arlington Books, Cambridge, 1959; *Old Garden Roses*, Part 1, by Sacheverell Sitwell and James Russell, George Rainbird Ltd., London, 1955; and *Old Garden Roses*, Part 2, by Wilfred Blunt and James Russell, George Rainbird Ltd., London, 1957.

Commendable action was taken by The New York State Nurserymen's Association, Inc., at a recent session of its Board of Directors. A resolution was adopted encouraging the current regulatory program of the New York State Department of Agriculture and Markets that is directed at removing from sale, at the retail level, plant materials that are not viable. The Nurserymen's Association further resolved that the Department should extend its efforts to discourage and apprehend all house-to-house canvassing of uncertified plant materials by unlicensed vendors.

Edwin W. Kirk, Executive Secretary of the New York State Nurserymen's Association, sent copies of the resolution to the Federated Garden Clubs of New York State Inc., to the Horticultural Society of New York, and other organizations, as well as to the Commissioner of Agriculture of the State of New York. His accompanying letter closed with this remark, "Gardening is a way of life. Let's assure everyone who participates in gardening an enjoyable experience."

The Smithsonian Institution is reprinting Paul C. Standley's *Trees and Shrubs of Mexico*, Contr. U. S. National Herbarium, Vol. 23, 1920-26, Parts 1 (pp. xviii + 1-169), 2 (xxxvii + 171-515), 3 (pp. xxviii + 517-848), and 5 (ii + 1313-1721), in two paperbound volumes containing parts 1-3 and part 5, respectively. The price of these four parts is $20.00 postpaid. Part 4 (pp. xxxix + 849-1312), available in the original 1924 edition published by the U. S. National Museum, will be enclosed free of charge. Orders, accompanied by check, should be addressed to Publications Distribution Section, Smithsonian Institution, Washington 25, D. C.

Errata. November-December, 1960, page 205, first column, first line, should read Dr. B. O. Dodge; page 210, caption, third line, should read *Ocotea;* page 243, first column, first line, should read Royal Horticultural Society.

January-February, 1961, page 6, second column, fourth paragraph, first line, should read As far back as the 1860s . . .

March-April, 1961, page 50, second column, second paragraph, fourth line, should read Marjorie Anchel; page 69, under "Appointment of Assistant Director (Botany)," second paragraph, third line, should read the Royal Botanic Gardens in Kew, Surrey, England.

BOOK REVI EWS (from page 110)

THE WONDERLAND OF PLANTS. Shannon, Terry. unpaged, illustrated, part colored. Albert Whitman and Co., Chicago, Ill. 1960. $2.75

Ages six to nine will find here an accurate botany primer presented most attractively. The text and art work were checked by Dr. Mildred E. Mathias of the University of California.

WONDERS OF THE ANTHILL. Lavine, Sigmund A. 64 pages, illustrated, indexed. Dodd, Mead and Co., New York, N. Y. 1960. $2.95

The vivid personalities of ants and their diversified vocations make good reading for young and old.

LETTERS TO THE EDITOR

I have so enjoyed Elizabeth Lawrence's book *Gardens in Winter* that I am moved to write to the Editor of *The Garden Journal* about it. Miss Lawrence calls attention to the many interesting and delightful plants that can be grown outdoors all winter long in the southern states, but northern gardeners need not be deterred from reading this book by thinking that it is of no value to them.

Miss Lawrence writes of the many fine trees that are handsome in the winter because of bark or branch formation. She tells of different shrubs, such as the Chinese witch-hazel, which will bloom regularly in midwinter in New York and New England. This particular year with its great fall of snow has caused the flowers to appear some weeks later than usual.

There are chapters on herbaceous plants which are handsome in winter, in bloom or in leaf, and much about small bulbs, particularly the dwarf narcissi and the scillas, and such iris as *I. histroides*.

The book is illustrated with line drawings by Caroline Dorman which would give distinction to any garden book and are, for their purpose, better than any photographs could be.

All these things probably can be found in other books, but I never have seen them brought together in this way. What makes this book stand out is the delightful way in which Miss Lawrence brings her talks and correspondence with gardeners all over this country and abroad into its pages. I have always felt that one great weakness in American horticulture is the general lack of realization of what other gardeners are doing and what plant explorers or plant breeders have produced for our gardens. This utterly charming book makes me feel I know the people about whom Miss Lawrence writes and that they are friends, as indeed they should be. I heartily recommend *Gardens in Winter* to all gardeners, not for the factual information about plants, but for its introduction to so many delightful people.

JOHN C. WISTER, *Director*
Arthur Hoyt Scott Horticultural Foundation
Swarthmore, Pennsylvania

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THE NEW YORK BOTANICAL GARDEN

Vol. 11, No. 4 July-August, 1961

THE GARDEN JOURNAL

THE NEW YORK BOTANICAL GARDEN

DOROTHY EBEL HANSELL
Editor

CALENDAR

September 5-9, 1961. Garden Holiday at Lake Mohonk House, Mohonk Lake, New York.

September 15-17, 1961. Penn-Jersey District Meeting and Rose Show at the Hotel Suburban and the Colonial Life Insurance Company Building, Prospect Street, East Orange, New Jersey.

October 25-27, 1961. Sixteenth Annual American Horticultural Congress, Northampton, Mass.

December 7, 1961. Holiday House Tour, sponsored by the Volunteer Associates of The New York Botanical Garden.

December 14, 1961. Theater Benefit, "Gay Life" at the Shubert Theater, sponsored by the Volunteer Associates of The New York Botanical Garden.

January 4, 11, 18, 25, 1962. Downtown Lecture Series, sponsored by the Volunteer Associates of The New York Botanical Garden.

April 27-May 7, 1962. Floralies, International Horticultural Exposition under auspices of Société d' Horticulture and Jardin Populaires de France in Valenciennes, France.

August 31-September 8, 1962. Sixteenth International Horticultural Congress, Brussels, Belgium.

April 26-October 1, 1963. International Horticultural Exposition, Hamburg, West Germany.

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While every effort is made by the Editor to avoid errors, the ultimate responsibility for all statements rests with the authors.

CREDIT FOR ILLUSTRATIONS

We are indebted to the Display Committee, Mrs. Charles Burlingham, Chairman, for the selection of the front cover illustration—water-lilies in the pool of the Conservatory Courtyard of The New York Botanical Garden by Gottscho-Schleisner, Inc.; pp. 113, 115, Charles C. Clare, Jr.; pp. 117, 118, 119, J. Horace McFarland Co.; p. 121, C. J. Wiest; pp. 123, 124, 125, Arnold Arboretum; p. 128, Fellmore Art; pp. 132, 133, Dr. John H. Miller and Yale University Photographic Service; pp. 134, 135, 136, 137, E. N. Mitchell; p. 138, Arnold Arboretum; p. 144, Charles H. Mueller; p. 145, 146, 147, Bowman's Hill State Wild Flower Preserve; p. 150, Julian A. Steyermark; p. 152, U.S.D.A. Photograph.

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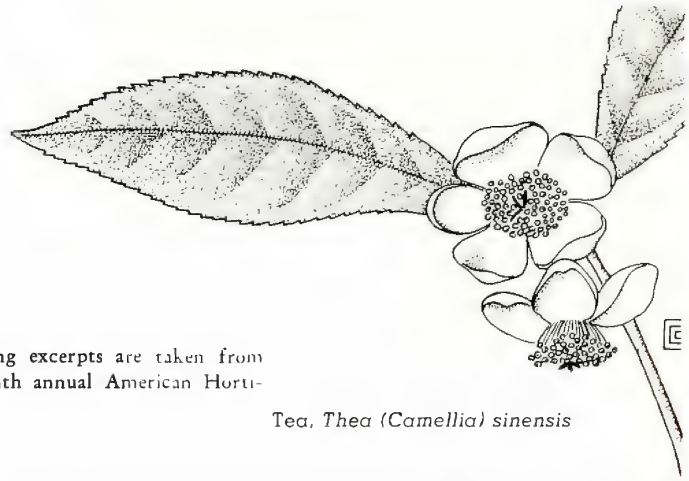
HISTORICAL NOTES ON THE CAMELLIA

By DOUGLAS G. THOMPSON

Mr. Thompson is the President of the Pacific Camellia Society. The following excerpts are taken from a transcription of the tape-recording of his talk on this subject at the fifteenth annual American Horticultural Congress held at Pasadena, California, in November, 1960.



Tea, *Thea (Camellia) sinensis*

IN A CURIOUS POETIC ALLEGORY, Robert le Grand many years ago wrote of the lost fragrance of the camellia. He told how Venus had ordered Cupid to be whipped with the stems of roses, and how Flora, goddess of flowers, who was moved by pity for Cupid dispatched Zephyr, the west wind, to Japan to bring back the stems of the thornless rose, known to the gods as Anacanthus and later to men as Sasanqua. The whipping of Cupid was then carried out in painless formality. Venus thereafter hated the thornless rose, deprived it of its fragrance, and banished it behind the impenetrable monsoon curtain of southern China. There it languished for untold years in a sun-warmed, semitropical forest, fed by the soft damp carpet of forest mold and watered by the rain mists, until found by man who prized it for the brew from its leaves.

Some have claimed that Confucius taught the drinking of cha or tea to insure the boiling of foul water. Others have pointed to the Emperor Shen Tung who was divinely led to the beverage in 2737 B.C. Then there is the provocative legend of the "Eyelids of Dharma." Whatever the origin may be, we know that by the seventh century drinking tea had become an important custom in China, and that by the eighth century Japan had borrowed and refined the art of brewing and serving tea into an esthetic, indeed a religious rite. For centuries, too, China and Japan harvested the seeds for domestic oil, a practice that still continues.

At the time the voyages of Columbus were opening up new worlds Feng Shi-Ko, living in Yunnan Province, China, listed in his botanical records some seventy-two varieties of camellias of the Ming Dynasty. He quoted from a thousand-year-old record of flowers and trees in the Imperial Park, in which he found names of "blooms exquisite in their imagery: Precious Pearl, Palace Exhibit, Rouge Colored, Strung Pearl, Illumine the Hall, and Thousand-Petalled White." The only one of all he described that might possibly be identified is Thousand Petalled-White. This may be *Camellia japonica alba plena.*

The history of the camellia in the western world began with tea a thousand years later. There is record of a letter, written in 1615 from one member of the East India Company in Macao to another member in Japan, in which he mentioned "a pot of the best sort of chaw." This is believed to be the first record of anyone mentioning tea in English. In 1659, the London journal *Mercurius Politicus* proclaimed in an advertisement that "excellent, and by all physicians approved, China drink called by the Chinese cha and by all other nations tay, is sold at Sultan's Head Coffee House." And in 1660, Thomas Garway, a proprietor of a London coffee house, offered this new drink as "good against crudities, strengthening the weakness of ventricle or stomach, causing good appetites and digestion, and particularly for men of corpulent body and such as are great eaters of flesh."

Also in 1660, there is a curious entry under the date of September 25 in Samuel Pepys' Diary: "And afterwards I did send for a cup of tea (a China drink) of which I never had drunk before." It is disappointing that Pepys fails to note his reaction.

Tea came to England with such impact that by the early 1700's close to twenty thousand pounds were being imported annually. It was purchased initially from the Plantations near the port of Amoy in the China Sea and later from Madras and Surat. Tea sold from four to fifteen dollars a pound, an expensive article by the standards of that day and within reach only of the affluent. It was a precious cargo for the clipper ships that were in competition in the China trade, and with the tea came the ornamental camellia plant, introduced in the hope that domestic tea culture might be possible. Sea captains, not botanists, are said to have unwittingly brought back the ornamental camellia, because the wily monopoly-conscious Chinese substituted it for the coveted tea plant *Thea (Camellia) sinensis.*

The flowering camellias resemble the tea plant; it is no wonder that European travelers to China in the seventeenth century were confused. They were restricted to the coastal areas, far from the tea-growing districts, and had to take the word of those who passed the plants to them.

Father Le Compte, who in visiting China had seen and classified both the species *japonica* and *sinensis,* ruefully commented that if the Chinese were not such great cheaters, their tea would be better. They frequently mixed herbs with the tea. John Barrow, another traveler to the Orient, mentioned the substitution of unrooted branches for authenticated rooted plants. The branches were merely pushed into the pots that had been placed aboard ship. There are doleful tales of potted plants smashed on deck by cannon fire, of seeds dried out and mildewed or completely corrupted by salt water, of tempests encountered in sailing around the Cape of Good Hope. In spite of trickery and tempests, some plants and seeds survived and reached Britain, but tea as such was not successfully grown there.

The first *Camellia japonica* is reported to have reached Europe in the last quarter of the seventeenth century—a tiny plant in an urn made of mother-of-pearl, a gift from a Moravian Jesuit to Maria Theresa, wife of the reigning King of Spain. The priest was Georges Josephe Kamel,

missionary to Manila. Since the Philippine climate is not suited to *C. japonica,* the plant that Maria Theresa received was probably not *C. japonica* but another species.

John Cunningham, an English physician, stationed at Amoy in the latter part of the seventeenth century, is credited with having had much to do with the introduction of camellias to Britain.

When the Swedish botanist and physician Carl Linnaeus (Dr. Carl von Linné) published his *Genera Plantarum* in 1737, he conferred the name *Camellia,* in honor of Father Kamel, on the plant in place of the Japanese name Tsubake. He thus honored Kamel for his contributions to Far Eastern natural history.

It is interesting to note that within the last few years records have been found which show that the camellia had made an earlier appearance in the western world than was previously known. The United States Department of Agriculture explored the ornamentals of Portugal in cooperation with Longwood Foundation, Inc., and in 1959 published the findings. This focused attention upon some very old, long-forgotten camellia trees, now considered to be the earliest specimens of *C. japonica* to have been planted in the western world. These are in the garden of Villa Nova de Gaya in Oporto, Portugal. The family archives of the Conde de Campo Bello, owner of the Villa, say that living plants of *C. japonica* were brought back from Japan and set out in the garden in the middle of the sixteenth century. And there they still stand after four hundred years.

Portuguese traders first made contact with Japan about 1542, and after 1550 exotic plants found their way across the sea. Portuguese were master mariners in their day, and captains, diplomatic envoys, and travelers participated in plant explorations during the Renaissance.

There is record of *Camellia sasanqua* in France in 1785, and in 1792 a captain of the East India Company brought back *C. japonica alba plena* and a few other varieties. By 1831 there were twenty-eight varieties of camellias in England, a remarkable achievement considering the hazards of transportation. Each plant rested in its own little earthen pot or woven basket with a handful of Chinese soil. Each little plant had to be nurtured month after month, in good weather or bad, through growth and bloom cycle, in order that it would reach its destination alive. This was no mean accomplishment.

In 1801 camellias were being propagated and sold in Belgium. In 1809 the first public exhibit of camellias took place at the Ghent Flower Show, and thereafter camellias became a regular feature of the show. Amateurs were encouraged to become collectors and nurseries sprung up whose names are familiar to all interested in horticulture—Verschaffelt, Donckelaar, De Longhe. The year 1825 was the "golden age of the camellia"—Verschaffelt listed one thousand varieties.

It was in France in the 1840's, however, that the popularity of the camellia reached its height. At that time no Parisian would have considered himself properly attired without a camellia boutonniere, and every one wept over Alexandre Dumas the younger's tragic tale *La Dame aux Camélias.*

During the mid-nineteenth century nurserymen in Italy, France, Belgium, and Portugal developed hundreds of new varieties. Ghent became the "camellia capitol of the world." Then enthusiasm suddenly waned, styles changed, and interest in the culture of camellias and in obtaining new varieties declined. By 1860 camellias were being replaced by long-stemmed roses, carnations, and strelitzias, and gardenias were proper for boutonnieres. By the beginning of the twentieth century the camellia had quietly disappeared, with carpet bedding, wired bouquets, and staid refinements of the Victorian period.

While Europeans were sipping tea and admiring exotic blooms, our American forefathers were becoming similarly intrigued. As in England, interest in America centered largely on how to derive more coins for the purse rather than on how to create fanciful new flowers. The story of the camellia in the New World begins in Georgia with attempts to cultivate the tea plant. Francis Moore narrates his trip to Savannah in 1738, when he visited the famous garden that had been laid out by General George Oglethorpe in 1733. He tells of the fruits and other plants—of apples, olives, figs, pomegranates, coffee, coconut, cotton—and comments on how bamboo, imported from faraway eastern India, flourished in the garden. He tells of tea seeds, shipped from East Indies Islands, but they, Moore relates sadly, did not grow although great care was given them. There is an interesting pronouncement in the United States Patent Office records of 1854 that the tea plants were imported to Georgia in 1772. It concludes that "hampered either by accident or from want of cultural knowledge, efforts to establish tea were unsuccessful." It seems certain that a planting on a limited scale was established on Skiddaway Island in Georgia. Anyway, the tea ventures of the South seem to have suffered because of insufficient capital, poor cultural practices on the plantations, and the mediocre quality of the tea itself. It was denounced by connoisseurs as weak—they contended that a strong brew required a robust climate, more temperate winters. American tea failed.

Individual specimens of *Camellia sinensis* continued to be grown under greenhouse culture, mainly as curiosities until the War between the States.

There is a record that the first shipment of *Camellia japonica* from Europe to this country was to John Stevens of Hoboken, New Jersey, in 1797.

The 1880 report of the Massachusetts Horticultural Society tells how Michael Floy came from England to New York and brought with him a plant of *Camellia japonica alba.* Mr. Floy established a nursery at Twelfth Street and Broadway in New York, and he planted the first seed of *C. japonica* in America in 1890. He introduced many fine varieties, a number of which are still grown today. Many other fine nurseries turned their attention to camellias. In Boston, Marshall P. Wilder and C. M. Hovey operated nurseries which became recognized throughout the world. Dr. J. S. Gunnell established his greenhouse across the street from the capitol in Washington, D. C. Two hundred and thirteen varieties were catalogued and distributed during the first quarter of the nineteenth century. At least seventeen of them are to be found in present-day collections. Interest in camellias passed its peak in this country when the clouds of the Civil War began to gather. Greenhouse culture of camellias died abruptly, and it was never revived to any great extent.

Left. *Camellia japonica.* Upper right. *Camellia sasanqua,* Palmer's Double Sasanqua. Lower right, *Camellia reticulata.*

At the turn of the nineteenth century André Michaux brought three plants of *Camellia japonica* to Middleton Place, South Carolina, and from this modest beginning arose the famed Middleton Gardens. He began what might well be considered the oldest outdoor planting of camellias in America. By 1840 Rev. John G. Drayton had imported plants from Belgium and France to Magnolia-on-Ashley, South Carolina, and created the Magnolia Gardens. In 1947 Magnolia Gardens offered one hundred and fifty of their own varieties which they had developed from seedlings. Many of these are the finest available today. Throughout the South, plantations featured camellias. In a sense, with magnolias and azaleas, camellias symbolized the way of life in the South—the pace and pattern of southern gentry.

Visited by war's ravages, and the palatial dwellings destroyed, the plantations and their gardens reverted to wilderness. During the difficult years of reconstruction, the camellia went out of fashion.

It was not until 1900 that Edward Avery McIlhenny began to scour the countryside of the South for any surviving camellia specimens. His interest spurred others. He brought the treasures he found to the Jungle Gardens on Avery Island, Louisiana. Under his enthusiastic leadership, the camellia was restored to favor and again graced southern gardens.

California came into the camellia story as early as the Gold Rush. In 1848, lured irresistibly by gold at Coloma, fifty miles south of Sutter's Fort, prairie schooners began to move across the Great Plains. The camellia pursued its relentless circumnavigation around the globe from China to Europe and eastern America and thence to California.

Among the stern pioneers there was James L. L. F. Warren of Boston, a plant lover and a man of foresight, who introduced the camellia to California. He followed the Gold Rush not to the mines but into the trucking business in Sacramento in 1851, and in connection with trucking he established Warren and Co., New England Seed Store. In January, 1852, he advertised the expected arrival of his first shipment of plants and seeds. This was followed by a notice in the *Social Union* of "receipt via Panama on February 7, 1853, of 3,000 lbs. of garden seeds, warranted fresh of every kind of new variety. A splendid set of dahlia roots, roses, camellias, grapevines, bulbs, etc., will be ready for examination in our hall above the store on Monday." The camellias arrived by Pacific Mail Company Steamship "Panama," "carrying four hundred and eighty-four passengers and forty females." *Camellia japonica alba plena, C. fimbriata,* and varieties 'Mrs. Albee Wilder' and 'Lady Hume's Blush' were in the groups of plants that went on display.

Warren's faith in camellias in Sacramento was not in vain. The first California State Fair in San Francisco in 1854 displayed many varieties. The Golden State Nursery in San Francisco advertised some seventy varieties, and a sizeable outdoor planting was made in Smith's Palmological Garden and Nursery in Sacramento. In the 1880's interest languished. However after two generations of neglect, interest was renewed, and in 1941 the camellia was declared the official flower of Sacramento. Today there are about fifty thousand plants in the city—more than five hundred varieties in Capitol Park—and in that park a special grove is dedicated to "Gold Rush Pioneers."

To the long-range vision of Henry P. Huntington—and his desire to possess a collection of rare plants—we owe the existence of the Huntington Botanical Gardens. In 1903 Mr. Huntington purchased the San Marino Ranch that had

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SHRUBS WITH FRAGRANT FOLIAGE

By HELEN M. FOX

Mrs. Fox is author of several books and has contributed articles on gardening to a number of publications. She is especially interested in lilies, herbs, and shrubs. Mrs. Fox is a member of the Advisory Council of The New York Botanical Garden.

BOTANISTS and others who write about plants and gardens seldom aptly describe fragrance. Perhaps the reason for this is that a vocabulary for smells is practically non-existent. Such words as spicy, minty, flowery, or camphoraceous have to be used; the scent of roses is described as either pure rose or like that of a fruit or spice. Many writers use aromatic, which means the same as fragrant and is not definitive. Botanists cannot be expected to be poets, but some, notably Liberty Hyde Bailey, have a remarkable choice of words for describing plants, and Linnaeus is a never-ending source of wonder in his selection of descriptive words for binomials.

The result of odor in plants, whether pleasant or not, is the attraction of insects which effect fertilization, except perhaps in pitcher plants. The odor of the latter, like that of decaying meat, serves to trap insects which may be used as food. Relatively few plants have fragrant leaves with the exception of the large family of *Labiatae,* some of the *Verbenaceae,* a few roses, magnolias, and so on. Fragrance is usually concentrated in the flowers, with the result that insects will go straight to stamens and pistils and assist in pollination. Plants with a strong scent do not, as a rule, have conspicuously colored flowers.

The longer one gardens with herbs, the more attractive and important fragrance becomes, and discrimination develops in detecting intensity of and difference in odors present in flowers, foliage, or roots.

HARDY NATIVE PLANTS

Where I live, in southern New York State, two native wildlings, both members of the *Myricaceae,* are found straggling along dry sunny banks. One is *Myrica pensylvanica* (formerly *M. caroliniensis*), having the common names of bayberry, candleberry, candlewood, candle tree, tallow herb, sweet-oak, and tallowberry, all descriptive of its uses or fragrance. Bayberry is a "herb" because of its medicinal virtues. According to *The United States Dispensatory,* it was once used extensively in medicine, for the bark is mildly stimulant and astringent, and in large doses emetic. *M. pensylvanica* is found from Nova Scotia to Florida and Louisiana, on the borders of the Great Lakes, and in Indiana. It is deciduous and spreads over a considerable area through its roots. In my neighborhood this shrub grows from four to six feet high, but sometimes reaches nine feet. The branches, cinnamon-colored when young and dark brown when old, have glands on them. The leaves are somewhat stiff to the touch, glossy above, and have many tiny glands on their under surface. They are rounded at the tip and wider above the center, and about three inches long. In autumn, the green is darkened with maroon. They smell deliciously of lemon, bay, and orange peel as does *Myrica asplenifolia.* The flowers are unisexual, the male in catkins and the female in rounded clusters; the latter develop into small round fruits with a gray covering which furnishes the wax for candles. This wax is also taken from the fruits of *Myrica cerifera.*

At one time a woman who worked for me would take a handful of the fruits, wrap them in cheesecloth, and rub the bottom of an iron with them. This imparted a pleasant fragrance to sheets and pillow-cases as she ironed them.

Another member of the *Myricaceae* is *Myrica asplenifolia,* sweet fern (according to Dr. Gleason in *The New Britton and Brown Illustrated Flora of the Northeastern United States and Adjacent Canada),* formerly called *Comptonia asplenifolia,* or *C. peregrina.* This low fragrant shrub thrives in sweet soil and in sun and is to be found in eastern North America and westward to Michigan. The plant, about three feet tall, has numerous brown branches which come into leaf early in May. The male flowers, as in bayberry, are pendulous brown catkins which are suspended over the rounded female flowers. The catkins are about one inch long, while the female flowers are small and round. The slender leaves grow out of old wood, are two inches long and half an inch across, furry above and below, and deeply and pinnately cleft. Both types of flowers as also the leaves turn maroon in the fall. The whole plant is fragrant, the leaves more strongly so. They smell, as does bayberry, of lemon, bay, and orange peel—at least according to my diagnosis. There is a great difference in the reporting of smells; some of this may be due to the weather, the season, and the individual.

Sometimes I pick a few of the leaves of *Myrica asplenifolia* and put them in a small pitcher or cup filled with hot water; the result is a delicious stimulating drink. *The Dispensatory of the United States of America* says the oil distilled from the plant contains considerable tannin as well as other constituents and was formerly used medicinally. On the northern tip of Long Island this plant grows in profusion, and it is said that Indian squaws used to pick it to sell to the settlers' wives.

From Maine to Texas the spice-bush, *Lindera benzoin* of the *Lauraceae,* is a common underbrush in woods. In April and early May when the clusters of little greenish yellow flowers appear on leafless branches, they create a mist-like effect through the trunks of tall trees. The flowers are followed by bright red fruits. The oblong-obovate leaves turn light yellow in autumn. The whole bush has a spicy, pungent aroma and tastes as true benzoin smells. (The true benzoin comes from *Styrax benzoin,* a tree native to Sumatra and Siam.)

Peter Kalm, a pupil of Linneaus, who traveled in eastern North America in the late eighteenth century, spoke of how refreshing it was to drink a beverage made from young twigs of the spice-bush, a drink he had learned about from the Indians. In his diary he says the drink was given as a stimulant and to cause perspiration and also as an emetic.

According to Rehder there are sixty species of *Juniperus.*

Bayberry *(Myrica pensylvanica)*

The low ones are admirable for borders and especially for rock gardens where they furnish a green background to early spring bloom, as well as attractive growth and fragrance all winter long. *Juniperus pfitzeri* and *J. horizontalis plumosa* are to be recommended because their leaves turn purple in winter. Variety 'Bar Harbor', which turns reddish and has a strong smell of camphor and turpentine, is also to be recommended. Many nurseries carry a considerable collection of these junipers, and it is a good idea to select them in winter when one can observe their coloration.

Junipers belong to "herbs" because of their fruits which are used in gin and also as remedy for kidney troubles.

Exotic Hardy Plants

The smell of box always reminds me of Old World gardens and particularly of gardens along the James River in Virginia where specimens have grown fat and humpy, and where their special scent composed of resin and almond pervades the air. The oval, glossy, evergreen leaves on *Buxus sempervirens,* the evergreen tree box, grow thickly on the branches, are notched at the apex, and are from one to one and a half inches long and paler green on the under surface. This box has many variants in form and color of foliage; among these are one with leaves variegated with yellow and another with leaves of a dark blue-green. *B. sempervirens* will grow to thirty feet high but is generally kept lower by shearing in order to train it as a hedge or as accent specimens. Because of this shearing, the flowers, pale green with yellow, seldom mature. This is a pity, for they are handsome and have a pervasive fragrance. The evergreen box is hardy in southern New York, but most gardeners cover it with unsightly burlap in winter. To keep off the sun and to prevent too early a comeback of growth in the spring, a light covering of salt hay can be spread over the plants and this covering held in place by branches of hemlock or other evergreens.

Buxus sempervirens is native to Europe, North Africa, and western Asia, and because of the elegance of its branches was widely used in decorations in olden days. According to the *Dispensatory,* its leaves cause dermatitis in some people and are poisonous if eaten. They were used medicinally in bygone days but are no longer considered to be therapeutic.

A dwarf box, called *Buxus microphylla* var. *koreana* by Bailey and Rehder, came from Korea in 1919. I was given one of the first plants by Leonard Barron and have had its descendants by way of cuttings ever since. It has a slight yellow tinge which is particularly noticeable in spring. In my garden the branches spread sideways, so I shear them back in spring to encourage them to form a close hedge. This box is the perfect edging for a garden in cold climates, being hardier than *B. sempervirens.* It is too low for a hedge, not being taller than two feet.

A few shrubs which rightly belong in the herb garden are so attractive, because of their fragrant foliage, good looks, and bloom from midsummer to early fall, that they grace any planting. These are *Vitex, Elsholtzia, Perovskia,* and *Caryopteris,* all exotics and all "die-backs." The problem with "die-backs" is their unsightliness in early spring, when they generally present a cluster of untidy stems of different lengths pointing hither and yon. The best way to handle them is to plant the taller ones behind low ever-

Benzoin *(Lindera benzoin)*

green shrubs and the lower ones among daffodils or lilies. If they are planted with lilies, they will probably bloom at the same time as *Lilium speciosum, L. henryi,* and *L. formosanum.*

A shrub of the *Verbenaceae* I have grown for many years is *Vitex negundo* from north China. It is a graceful, much-branched shrub which will grow ten feet high. The branches are four-angled. The opposite leaves feel soft to the touch but are firm enough to stand out. The flowers are borne in mid-August in branched spikes; each branch is five inches long. The corollas are two-lipped and funnel-form, violet and white. The whole plant has a pleasant strong resinous aroma. I raised mine from seed and grow it on a sunny slope behind broom.

A variety called *incisa* has deeply serrate and practically pinnatified leaves. The whole plant, as also the leaves, is smaller than the type.

Vitex agnus-castus or chaste-tree, also called monks pepper-tree and hemp-tree, comes from southern Europe and western Asia and has been in cultivation since 1570. (There are about sixty species of *Vitex* in tropical and sub-tropical regions.) This shrub will grow to nine feet high. The violet flowers are produced in whorls along a single spire, about four and a half inches long. There is a white-flowered form called *alba.* The flowers on both last a long time; they appear in mid-July and continue well into August. The leaves are five-divided, pointed, grey-hairy underneath, and have entire margins. The leaves smell pungent, rather like pine, and the flowers a little of heliotrope.

The branches make excellent cut flowers and are good companions to gladiolus. In ancient days the trunk was used to make statues of gods. However, *Vitex* is not listed in the *Dispensatory.*

Late in August an inconspicuous shrub mingles its somewhat prostrate stems among other plants in the garden. This is *Perovskia abrotanoides* of the *Labiatae.* The shrub

Vitex negundo

comes from an area extending from Afghanistan to Thibet and was introduced to cultivation in 1904. I have grown it and *P. atriplicifolia;* the latter appears more upright and taller, reaching five feet in height. They both require sunny, well-drained situations. *P. abrotanoides* comes out of the ground long after other plants and is often shaded by the earlier ones. It is called Russian sage, but to me does not smell nor look like sage. It smells like rosemary, only not so sweet, and looks like some of the lavenders, such as *Lavandula canariensis.* The stems are square and slender; the young stems are silvery, almost white. The flowers are borne apart, not close to one another, in branched panicles. They are two-lipped, violet-blue, and three-eighths of an inch across. The gray-green leaves are twice-divided, almost pinnately, and are one and a half inches long and the same across. Both of these plants are handsome and particularly charming when grown among the blue-green foliage and mustard-yellow flowers of rue *(Ruta graveolens.)*

Caryopteris incana from north China is commonly called bluebeard. This member of the *Verbenaceae* is a late September-flowering shrub; it grows about two feet or more high. I once had it in a sheltered place on a slope where it persisted for several winters. I also had a white- and a pink-flowered form, but there is no mention of these today in any of my numerous plant dictionaries, nor can

Perovskia atriplicifolia

Bluebeard (*Caryopteris incana*)

I find them in catalogues. The stems are green, tinged magenta, entirely magenta at their summits, and they are covered with short hairs. The leaves have large, rounded teeth, and their upper surfaces are velvety. The flowers are in opposite whorls. Each blossom measures three-quarters of an inch across; the calyx is green tinted violet, the slate-blue corolla is deeply lobed, and the stamens are exserted. In *C. mongholica* the leaves are lanceolate, and have either few teeth or none at all. The fragrance of both is pleasantly resinous with a slight trace of rosemary.

Caryopteris clandonensis 'Simonds' is entirely hardy where I live. I raised it from seed which came to me from the Royal Horticultural Society. It is about two feet high, and blooms in early September on this year's wood, so that it has to be pruned back hard. The leaves, narrow and ovate, have a few teeth along the margins. The blue flowers appear feathery. The whole plant has a suede-like finish and is fragrant. My plants have been increased by cuttings and now, planted between peonies, form a fringe to my shrubbery border.

A shrub which was introduced from north China in 1909 is *Elsholtzia stauntonii* of the *Labiatae.* It thrives in sun and seems to go limp in shade. It is a die-back, and its bare untidy twigs present a sad sight in spring. In my garden it grows about three feet high, but is reported to reach five feet. Perhaps it would be taller in a milder climate, but I cut back the stems quite far down in fall. *E. stauntonii* can be readily increased by division; the stems are not too woody. They are stiff, green, hairy, and smooth to the touch. The leaves are long and slim, wider below the center with large teeth, hairy yet smooth to the touch. They are thin-textured, one and a half inches across and five inches long. When rubbed they smell of mint, though not so sweet as true mint. The flower-crowded whorls form one-sided, spire-like inflorescences at the tips of branches. Some measure five and a half inches long; but others are smaller. The flowers are a velvety plum color, lighter than the form called *farquhari* that I bought some years ago. *E. stauntonii* is not in the *Dispensatory.*

The rose best known for its fragrant leaves is *Rosa eglanteria,* the sweetbrier or eglantine. It has densely interlaced branches, five to seven feet high. The oval leaves (five to seven) are glabrous and hairy beneath. They smell like green apples when wet. The bright pink flowers measure one and a half to two inches across, and may be solitary or up to three together. The sepals are pinnate and semipersistent. The fruit is ovoid, orange-scarlet, and to one inch long. *R. eglanteria* is of European origin; *R. rubiginosa* is given as a synonym. Var. *duplex* has double flowers. The single form is one parent of the famous and beautiful Penzance Hybrids.

Exotic and Not Hardy

Where I live in Westchester County, New York, the tall lavenders such as *Lavandula officinalis* and *L. stoechas* are not hardy, but plants of *L. officinalis* var. *compacta,* a dwarf form, have proved to be hardy except in severe winters. The dwarf plants are twelve inches or so high and become quite broad; in fact, after three years in the garden they can easily be divided. They are shrubs because of their woody stems, but they are usually classed as herbs—and they are herbs because their fragrant foliage is used in cosmetics and medicine. The whole plant is redolent of lavender; however, the greatest concentration is in the flower buds. Dwarf lavender has flowers in several shades of violet and pink, which I have found to be the most fragrant. Lavender blooms from late June through July, and during this time it dominates the garden with its

Elsholtzia stauntonii

beauty. Its foliage remains violet-tinged all winter. I always make cuttings to carry over in a protected coldframe in order to have replacements to meet such disasters as may occur in a snowless temperamental winter, for I never know when the plants will come through unharmed.

In favorable circumstances, *Rosmarinus officinalis* will develop an almost tree-like trunk, to six feet high, with somewhat shredded bark. This shrub originated along the Mediterranean and is temperamental as to hardiness. I grew it in my former garden along the Hudson River, and there it came through unharmed. The leaves are long and narrow with incurved margins and arch to show the grey undersurfaces. There are specimens with needle-like leaves, and some have a somewhat pyramidal shape. The typical color of the flowers is a light blue, but there are forms which have white and also pink flowers. *R. officinalis* blooms in late winter and on into May. The whole plant is very fragrant; it has a characteristic warm odor, sometimes described as balsamic. Var. *prostratus,* a low recumbent form whose branches are level with the ground, is the least hardy. Rosemary is a famous "herb," whose leaves are used for perfumes and medicines and as flavor in food.

A friend of mine, Violet Walker, who lived in Woodbury Forest, Virginia, had huge tall bushes of lemon-verbena, *Lippia citriodora,* in enormous pots. These bushes had been grown by the previous generation. They were wintered in an enclosed but unheated place and wheeled into the garden every spring. My plants, too, are brought in for the winter. They are small, however, and do not grow over two feet high. *L. citriodora* truly smells of lemon, and the leaves are delicious when steeped in teas or added to syrups in cooking fruit and making jellies, along with the fragrant-leaved pelargoniums. (The latter are not included in this article, because they behave more like perennials in this climate, although in California, Mexico, and similar climates they develop tall bush-like growth.) The leaves of lemon-verbena are slender, grow in whorls of threes, and are crisp in texture. They have a prominent central vein depressed on the upper surface. The flowers are tiny, very pale lavender, and grow in terminal panicles. They are not medicinal. The plant came from Argentina and Chile and was named for Dr. August Lippi, a French traveler. It has been in cultivation since 1784.

Myrtus communis of the *Myrtaceae* comes from southern and eastern Europe and on into Persia and Afghanistan, where it grows ten feet high. The young wood is brown and downy. The plant has thick, glossy foliage; each leaf is pointed and about one inch long. The leaves give forth a scent of rosemary combined with flowery elements but are bitter and taste of laurel. Snow-white flowers, their centers filled with frothy white stamens, appear in summer; they are nearly always solitary and on short stalks. The flowers are followed by purple-black fruits, one-half of an inch across. *Myrtus communis* furnishes a beautiful hedge and is planted for this purpose in California. It thrives in hot situations. For me, alas! it is not hardy and has to be wintered in a greenhouse. The plants yield an oil, called "myrtol," which is antiseptic and stimulant and has been used in bronchial and pulmonary disorders.

Laurus nobilis, the sweet bay or bay tree, of Mediterranean origin and belonging to the *Lauraceae,* is the laurel of legend, history, and poetry. The leaves smell of bay and have a distinctive, somewhat pungent cinnamon flavor. They are from two to five inches long, short-stalked, and terminate in points at both ends. The margins are slightly undulating and are crisp and hard to the touch. When raw they taste bitter, but cooked in soups and stews they impart a spicy unusual flavor. The greenish white flowers, half an inch long, are followed by egg-shaped fruits which ripen black and are thought to be emmanagogue. The oil they yield is used in perfumery. The bay tree grows slowly and is not reliably hardy north of Zone 6. Where it has to be wintered indoors, it does well in a wooden tub. It likes a peaty soil and plenty of moisture. *L. nobilis* is readily increased by cuttings.

Readers of *The Garden Journal* may be familiar with the beautiful blue-green, highly scented leaves of *Eucalyptus,* as these are to be found in florists' shops and are used in flower arrangements. They probably are not so familiar, however, with the red, white, or yellow flowers whose beauty rests in their numerous showy stamens. There are three hundred species of *Eucalyptus,* practically all native to Australia; they belong to the gum tree family or *Myrtaceae.* Eucalyptus are included here because, though most of them are tall trees, a few low species would come under the heading of shrubs. Among these are *E. cornuta, E. macrocarpa,* and *E. preissiana.* Eucalyptus are grown in many warm countries, notably Israel, along the French Riviera, and in California, where they are admired for their unusual appearance. They furnish wood for fires and pasture for bees. Because the long narrow leaves curl up and drop on the ground, eucalyptus are, however, somewhat untidy.

DWARF ROSEMARY AN ELIGIBLE HERB FOR BONSAI

By ELEANOR P. CHALFIN

Mrs. Bruce Chalfin of Plantation Gardens, Rustburg, Virginia, is well known for her fine collection of herbs.

HAVING ALWAYS DOTED on tiny and ancient Oriental things, I became bitten by the bonsai bug when I chanced upon an article about the fad for bonsai in this country. As I am a dedicated gardener with faithful allegiance to herbs, a list of possible plants quickly suggested themselves. Dwarf rosemary *(Rosmarinus officinalis prostratus)* led all the rest and subsequently did not let me down in any way.

My first step was to study an authoritative book on the art of creating, training, and caring for bonsai plants. The advice in *Miniature Trees and Landscapes* by Yugi Yoshimura and Giovanna Halford (a present from my son, then living in Japan) was simple to follow. I hoped for beginner's luck, since I was not choosing a cranky shrub, a troublesome tree, an ancient or unfamiliar plant, but a tried and true herb. Dwarf rosemary proved a perfect made-to-order plant for the role. The choosing of a three-year-old, one that would possess the proper patina to play the part and already be container-trained, set the stage. Then I asked myself, "Should it be cascade style, lopped off for a semi-

upright, left erect, or have a list to the side?" Semi-upright, slightly slanting seemed to me the right decision.

So with my feeling toward the plant subdued for the nonce, I snipped the first small twig. Before I dared to shear more, I slept on the problem. It was not until I felt sure enough that the judicious clipping began, in which I followed a preconceived pattern by cutting a few branches part way on the plant's left side. Since there are a front and a back to any bonsai, the shearing starts on the least developed side—even a well-rounded, natural specimen usually has one poorer facade. After another interval, when the rosemary showed no ill effects from its amputations, the final shaping was easy and the end in view accomplished: the herb was gracefully leaning in a very Japanese manner.

In spring the potted rosemary was set out on a sunny protected terrace, and the plant generously continued to bloom, with only the short flowerless space in midsummer that is its normal habit. The following fall root-crowding was evident. As I did not have an artistic container, I transplanted it into a larger-sized common clay pot, broader and more squat. Some side roots were first pruned, and the bottom soil was tenderly teased from the ball of earth with chopsticks—a pencil could have been used. My precious pigmy was then supplied with some new soil. During winter the plant was extended the hospitality of a cool, sunny greenhouse, where it gave weeks and weeks of floriferous performance.

A new thrill, the next spring, was to find that a rosemary of the *Forrestii* variety, which had been tucked in a coldframe for winter protection, had lost its symmetry toward the rear, had a waterfall of foliage in front, and was slim on both sides. Behold, a "do-it-itself" cascade bonsai— and with blossoms to boot, for the plant was budding bountifully and soon burst into full flower when transferred to the niche of a serpentine brick wall. There it could nestle comfortably, but remain sunned only on three sides to retain the self-produced guise.

Having two types of rosemary, differently styled, I am keen to try my hand at other herbs à la bonsai. Would *Lavandula stoechas* and *Artemisia canariensis* prove as elegant and eligible, as trimmable, trainable, and tractable? I doubt whether the littlest rosemary has any other herb contestant in these qualities, but I mean to experiment further.

I hope that readers of *The Garden Journal* are already acquainted with the two charming characters briefly mentioned here, since this short piece, like my plants, had to be pruned to size. But whether bonsai fashion or taken at face value, the little-leaved, small-statured rosemaries deserve a special spotlight. I am sorry that this condensed form cancels description of their evergreen costume and their jewel-like blue blossoms, and leaves small scope for cultural directions.

But a few quick pointers: outdoor life for the plant as much as possible; a sunny spot at all times; and a pot watcher ("plant-sitter") if you must be away from home so that the watering schedule is not skipped.

Plants may be purchased from a herb nursery or may be started from seeds bought from growers specializing in rare herbs. Seeds of dwarf rosemary germinate more quickly and more easily than do seeds of the common rosemary, *Rosmarinus officinalis.*

Dwarf rosemary trained as a bonsai plant.

THE MAGIC OF COLOR

By MARY FLEMING

Mrs. Fleming, who is Technical Assistant in the Cryptogamic Herbarium, is an enthusiastic gardener. She is active in the American Rock Garden Society and in the American Rhododendron Society.

THE EFFECTIVE USE of color combinations in flowering plants was impressively demonstrated by the massive plantings of the golden-yellow *Forsythia* and the lavender-pink *Rhododendron mucronulatum* that lined either side of the highway on the west side of the George Washington Bridge and came into view just after one left the toll booth. Undoubtedly this spectacular sight in early spring inspired

many to seek, as I did, the identity of the lavender-pink shrubs. A number of nursery catalogues were explored before I found a picture of the Korean rhododendron. (Other yellows that I have combined with *R. mucronulatum* are *Jasmine nudiflorum* and daffodils, and I am planning to use *Corylopsis,* a winter-hazel from Asia and a member of the witch-hazel family.)

Three years ago we moved to a new home, and my husband and I have developed a garden under huge trees. Instead of recovering and maintaining a formal lawn, we made plantings around the trees. Under an old saucer magnolia *(M. soulangeana)* we have massed hardy azaleas and rhododendrons. These are varieties in shades of lavender and purple: 'Conewago', 'Ramapo', 'Corsage', 'Sherwoodi', 'Purple Splendor', 'Herbert Gable', and others. The arching branches of the purple and white magnolia pick up the color of the rhododendrons, and the play of sunlight and shadow produces a striking pattern. Now the magnolia has rained its bloom and is turning green, and the white of azalea 'Indica Alba' or 'Ledifolia' *(R. mucronatum)* is showing. Soon the evergreen, salmon-pink azalea 'Louise Gable' will predominate, set off to advantage by the backdrop of Canadian hemlocks *(Tsuga canadensis).* On the opposite side of the driveway under another magnolia, the very early-flowering *R. mucronulatum* is cloaked in its green leaves. In company with it are other deciduous species of azaleas; the pinkshell azalea *(Rhododendron vaseyi)* is in bloom, and the pinxterbloom *(R. nudiflorum),* the swamp-honeysuckle *(R. viscosum),* and the sweet azalea *(R. arborescens)* will show their colors later. These are underplanted with club mosses *(Lycopodium lucidulum),* bleeding-heart *(Dicentra eximia),* Oconee-bells *(Shortia galacifolia),* and *Galax aphylla.*

Close by in the shadow of the majestic Atlas cedar *(Cedrus atlantica glauca),* the beautiful royal azalea *(R. schlippenbachii)* is in full bloom; the yellow *R. keiskei* has already spent its bloom. Next to a Swiss pine *(Pinus cembra)* are deciduous Ghent azaleas. The scarlet buds of Mollis hybrids are breaking, and before long their buttercup-yellow and orange tones will be in harmony with the blue forget-me-nots *(Myosotis scorpioides)* and ferns at their feet. The fragrant, pale yellow Ghent azalea 'Daviesi' is particularly delightful in this setting.

Under a linden tree *(Tilia vulgaris)* are the evergreen azaleas 'Sherwood Red', 'Sibelius', and 'Stewartiana' in brilliant reds, their intense colors softened by the serene white 'Delaware Valley', 'Rose Greeley', 'Palestrina', and 'Snow' Reds which tend to be blotched by the sun are placed in dappled light; white flowers are put in darker spots where they are seen to advantage. Like a prima donna the beautiful dwarf *R. carolinianum* hybrid 'Windbeam' in full sunlight charms all who see its delicate pink flowers.

A look at one's garden brings the whole into focus, and careful attention not only to the immediate company of plants but their backdrop as well may suggest the replacement of a plant or plants for harmony of color.

Readers of **The Garden Journal** may be interested to learn of the series of articles on "Colour Schemes for the Small Garden" by David Wright, M. A., in the **Journal of the Royal Horticultural Society.** Part I, which appeared in the May, 1961, issue, discussed blue gardens, a scheme in palest yellow to include greenish yellows, primrose-yellow, and creamy yellow, and a scheme in greys, purples, and strong yellows. The Editor.

THE CAMELLIA (from page 115)

been owned and developed since 1848 by the pioneer rancher J. D. Barth Shorbe.

William Hertrick, now the distinguished Curator Emeritus of the Huntington Botanical Gardens, was engaged in 1905 to landscape this San Marino property. There were two twenty-year-old camellia plants on it. In 1909 Mr. Hertrick added camellia plants, purchased locally, to stock an Oriental garden; in 1918 he obtained plants direct from Japan. By 1944, the Huntington Botanical Gardens had seventy-five varieties. It was in that year that the Southern California Camellia Society began to take an interest in these gardens—they had become a public trust through the Huntington Estate. The Society has arranged for and coordinated the development of a camellia testing ground, and has set out to make it a place where the greatest number of camellias, properly labeled, may be grown.

During the first years of the twentieth century many camellias came from Japan. These bear recent names—names that do not belong to antiquity. Most camellias, however, in the 1920's, were sold by color—white, pink, red, variegated; in the mid-1930's, almost all were sold by name.

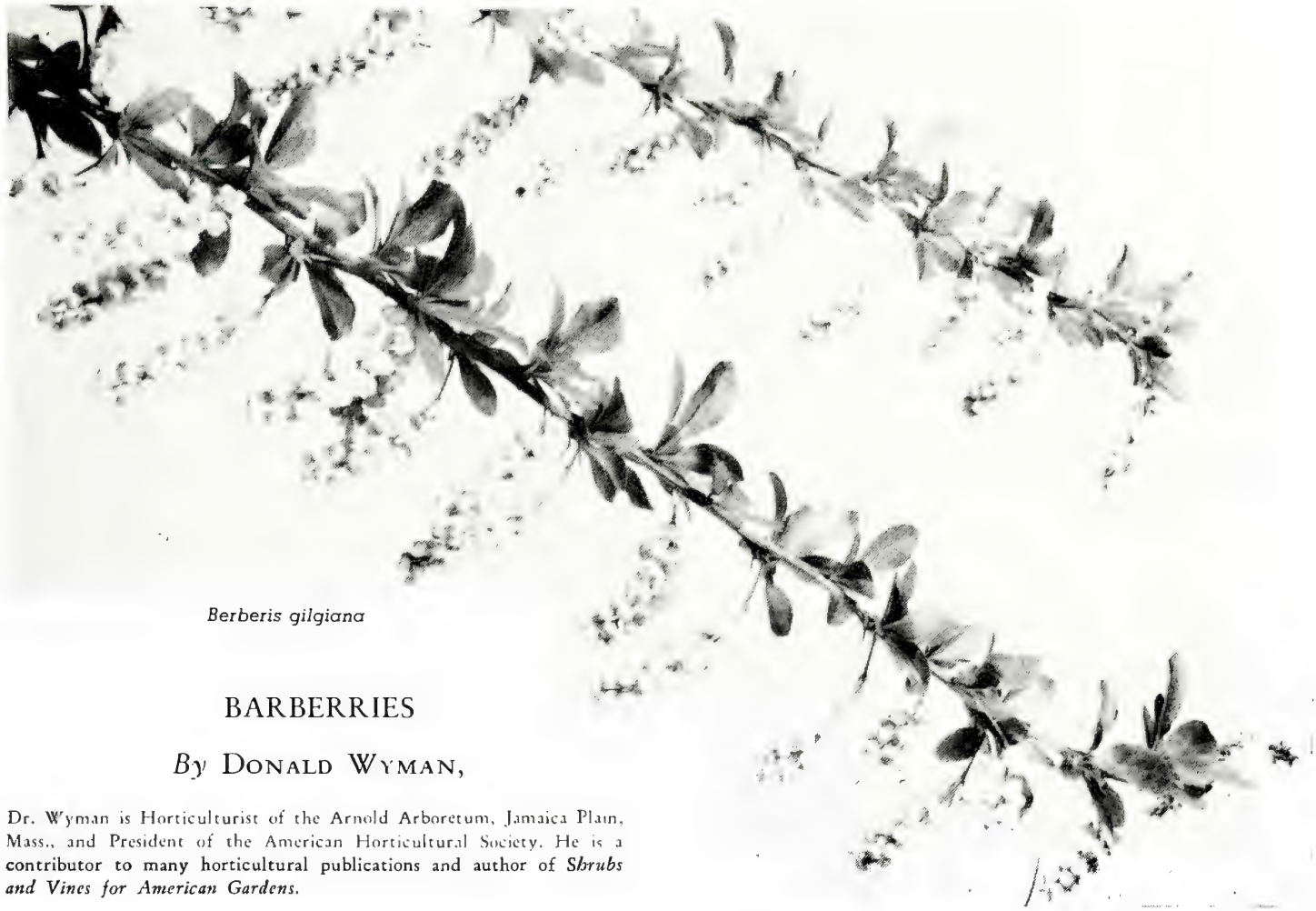
From the mid-1930's there has been a remarkable resurgence in camellias. Camellia societies were formed, camellia shows became annual events, collectors' enthusiasm reached an all-time high, nurseries found their sales of camellias increasing. In 1940 Manchester Boddy planted camellias—on thirty acres shaded by California live oaks—on what is now Descanso Gardens, the last remaining parcel of the land grant to Don José María Verdugo from the King of Spain in 1784. (Descanso Gardens are operated by the Los Angeles County Department of Arboreta and Botanic Gardens and the Descanso Gardens Guild.)

This camellia revival was accompanied by confusion in nomenclature. This exasperating problem is gradually being straightened out. In this respect, The American Camellia Society, organized in 1945, has been most helpful. Through its leadership and efforts more information on camellias—their history, their culture, their nomenclature—has been published than in any preceding period.

To southern California belongs another significant camellia contribution. In 1948 a shipment of twenty plants of *Camellia reticulata* arrived from Kunming, China. About the same time, the late Ralph Peer, former president of the American Camellia Society, independently procured a similar shipment. These two shipments were combined into a joint propagation project, and it now appears that there may be thirteen or fourteen distinct varieties of *C. reticulata.* [In 1924 *C. reticulata,* or Captain Rawes' camellia, was introduced to California by Eric Walther, Curator of Strybing Arboretum, Golden Gate Park, and a plant was given to the botanical garden of the University of California, Berkeley.]

There are exciting possibilities of other species and varieties with yellow and with purple flowers in northern Indo-China. These are tantalizingly out of reach, but if we can ever get behind the Bamboo Curtain, hybridizing with these unknowns could extend the color range.

Will the present revival last? We do not know. We can only be glad that the camellia has returned to popularity in our generation.



Berberis gilgiana

BARBERRIES

By DONALD WYMAN,

Dr. Wyman is Horticulturist of the Arnold Arboretum, Jamaica Plain, Mass., and President of the American Horticultural Society. He is a contributor to many horticultural publications and author of *Shrubs and Vines for American Gardens.*

AT THE TURN OF THE CENTURY, barberries were not frequently seen in gardens. They were rare plants. Fortunately, as a result of plant explorations throughout the world, many species and varieties are now being grown. In fact, the Japanese barberry that was a rarity in 1900 is now one of the commonest of all garden shrubs—it still remains at the top of the list as the most rugged and serviceable of plants. Also, it has run wild in the United States. Before I discuss some of the individuals in this group, let me first explain some points about the group as a whole.

Barberries are native in Europe, Asia, South America, and North America. The native North Americans do not compete well as ornamentals with those from other lands. The early settlers in America brought the common barberry, *Berberis vulgaris,* with them from Europe, because it was a vigorous, easily grown shrub, about nine feet tall, looking well in flower and fruit, and also possessing some economic value. The fruits were used in jellies. It thrived in America and soon became widely naturalized.

Then, in some of the wheat-growing areas it was noticed that the black stem rust of wheat, a serious disease, was always prevelant where the common barberry was growing. The best way to control the disease was thought to be to eliminate the barberry,* and in 1918 Federal legislation was passed to do just that. Some of the early colonies had passed legislation calling for barberry eradication as early as 1726. Today there are nineteen states where eradication programs are being carried out, namely, Colorado, Illinois, Indiana, Iowa, Kansas, Michigan, Minnesota, Montana, Nebraska, North Dakota, Ohio, Pennsylvania, South Dakota, Virginia, Washington, West Virginia, Wisconsin, and Wyoming. Each year more than six hundred dealers' establishments and nurseries are inspected and issued certificates which permit interstate shipment of rust-free barberries.

Of some one hundred and seventy-five species and many more varieties of barberries, the United States Department of Agriculture lists sixty-four species and varieties that are sufficiently rust-resistant to be grown, shipped, bought, and sold in the wheat-growing areas. Not all of these are excellent ornamentals, but the list does include the most serviceable and beautiful of the genus. Only about two dozen of these are being offered commercially by the trade, but even these are enough to satisfy most gardeners.

Barberries vary in height from six inches to ten feet, but most of them are under five feet tall. They have the enviable reputation of being able to grow in poor dry soils. They have small yellow flowers (some of those grown in the South have beautiful red flowers) and either red, yellow-orange, blue, or black berries. Most of the barberries have short thorns which make them effective as hedge plants. Some are evergreen, and it is these that the home owner

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Control of stem rust is largely by use of resistant varieties of wheat and other cereals and by means of barberry eradication. The eradication of barberry is important in temperate zones, because it breaks the cycle of the parasite and thus prevents early spring spread of the rust to cereals. However, the rust develops on cereals in the South through the winter and moves northward into green spring cereal areas. Hence rust can occur even though barberry has been eradicated. Of greater importance justifying the destruction of barberry is the fact that new races of rust originate on barberry plants, and the new races may be able to infect resistant varieties of the cereals. C. R.

Berberis koreana

should scrutinize carefully for outstanding garden subjects.

The only barberries worth growing today are those that the United States Department of Agriculture classifies as "rust-resistant." Consequently, all that are mentioned in the following paragraphs can be considered in this group, and most are available from some commercial source in America, although, admittedly, it will take a little searching to find some of them. Also, only those that are thoroughly hardy in the New York City area will be mentioned; however, it should be remembered that some of the beautiful ones seen in Scottish, Irish, and English gardens (like *B. lologensis, B. stenophylla* and its many forms, and *B. darwinii)* can be grown in the warmer gardens of the southern United States.

First for consideration should be the evergreen types. The warty barberry *(B. verruculosa),* one of the best, has spiny, dark green leaves which are white on the underside. It has a low (four feet high) compact habit, black fruits, and is a native of western China. Because of its habit it makes an excellent single specimen. It seems a pity to spoil their shape by growing plants of *B. verruculosa* closely together.

Berberis julianae grows to about six feet tall, has an upright habit, and definitely is more hardy than *B. sargentiana,* which need not be used. The spiny, evergreen leaves are sometimes three inches long. The black barberry *(B. gagnepainii),* another evergreen (from western China) is not especially outstanding, but is sometimes grown for its rather open habit.

What is proving to be the best of the evergreen types in the Arnold Arboretum is a hybrid named *B. chenaultii,* which originated about 1928. It grows only four feet tall. It is possessed of vigorous growth; the foliage looks well throughout the entire winter, even though the dark bluish fruits are only sparsely produced. The lowest of these evergreens is the dwarf Magellan barberry, usually under two feet tall. However, it can freeze out or winter-burn some years, even though its native habitat is beside the Magellan

Five species of *Berberis:* 1. *B. verruculosa* 2. *B. triacanthophora* 3. *B. chenaultii* 4. *B. julianae* 5. *B. gagnepainii*

Straits of South America.

A word should be said about the semi-evergreen *B. mentorensis,* a hybrid between *B. julianae* and *B. thunbergii,* which was originated in 1924 by A. V. Horvath of Mentor, Ohio. It has many characteristics of both parents, and has withstood winter temperatures of —20° F without injury. It has deservedly won a reputation in the Midwest, because it is able to withstand the hot dry summers better than almost any other barberry. An old plant of *B. mentorensis* in the Arnold Arboretum is seven feet tall and twelve feet across.

Fortunately for all of us, the Japanese barberry now has many varieties. This plant, first introduced to America in 1875 by the Arnold Arboretum, has widely served many a garden purpose in thousands of gardens throughout the country. Everyone is familiar with its rounded form, thorny branches, bright autumn color, and bright red fruits in the fall. The fruits may remain on the plant all winter long and still be present when the young green leaves appear together with the yellow flowers in the spring. Added to these ornamental features is its ability to grow in poor soil, to withstand shaded situations and drought, to take shearing very well indeed, and to make a serviceable hedge as well as a singularly geometric specimen.

It has become almost too commonly planted, but now varieties are available for those who like to have something a wee bit "different." There is a form *atropurpurea* with reddish leaves a greater part of the summer. A new variety called 'Red Bird', which came out in 1959, is supposed to be of a more brilliant red color and denser habit than *atropurpurea.* There is also an upright form of *atropurpurea.*

Then there is the little 'Crimson Pygmy'; this may also be listed as 'Little Gem' or 'Little Beauty', a plant that originated in Holland before 1952. The eight-year-old plant at the Arboretum is only two feet tall and three feet across. It colors much better in the full sun than it does in the shade, and makes an excellent low border or hedge, which requires practically no attention.

Most gardeners are familiar with the so-called columnberry or upright Japanese barberry *(B. thunbergii erecta)* which originated in Ohio before 1936. It may be of interest to know that our twenty-eight-year-old plant is only five feet tall but ten feet across, with all the branches definitely upright. Then there is the variety called 'Globe', a selection from a nursery in Casstown, Ohio, which was patented in 1936. This is definitely a dense globe-shaped plant—ours is twenty-seven inches tall and four feet in diameter.

One of the most neglected varieties of Japanese barberry is *B. thunbergii minor.* In all its parts—form, leaf, flower, and fruit—it is smaller than the species; it is otherwise like the common plant but of much finer texture and, to my way of thinking, a better ornamental in every way. There are also a "thornless" variety, a variegated-leaved variety, and a yellow-fruited variety, but these are of little interest outside botanical gardens and arboretums.

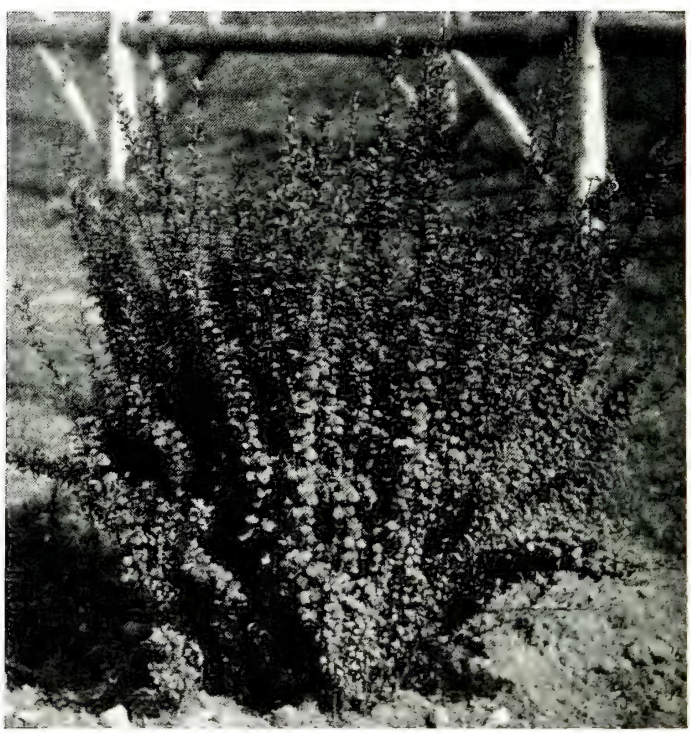
To replace the common barberry *(B. vulgaris),* which is susceptible to the wheat rust, there are two excellent deciduous species which are resistant and can be grown. Both are natives of the Orient, both are vigorous, and both have bright red fruits and fiery red autumn color. The

(Continued on page 138)

Berberis thunbergii minor

Berberis thunbergii nana

Berberis thunbergii erecta



THE BROAD FUNCTION OF A MODERN BOTANICAL GARDEN

By FRITS W. WENT

The following is based on the talk that Dr. Went, Director of The Missouri Botanical Garden, gave at Members' Evening of The New York Botanical Garden on February 28, 1961.

SINCE I am to talk about the broad functions of a botanical garden, my task would be lighter if we all agree on what a botanical garden is. The most general definition seems to me: an extensive collection of correctly labeled, living plants. This collection, of course, should be significant in one way or another, either by being complete or by being rich in special groups or types of plants. Once we have settled on this definition, we should find a reason why we need living plants at all. As a repository of plant species, an herbarium is, at the moment, the generally accepted standard, and a species that is described has to be available in the form of herbarium material rather than as a living specimen. Let us, therefore, see what the function of a botanical garden was in the early days.

The very first botanical gardens were purely for teaching. They were medicinal herb gardens for the training of medical students during the Middle Ages. One of the first such gardens was founded at the Vatican in the thirteenth century. The oldest, still-existing botanical garden is the one at Padova which was founded in the first half of the sixteenth century. Gardens of medicinal plants were essential for the training of a physician in those days. Very little was known about the now generally accepted branches of medicine, and the major function of a physician was to prescribe drugs which were almost exclusively of plant origin. He had to know his plants well, and most professors of medicine were also botanists.

During the sixteenth century some of these physician-botanists grew not only medicinal plants in their gardens, but many other types. Clusius, for instance, brought together an exclusive collection of flowering bulbs at the botanical gardens in Leiden, Holland, which proved to be the beginning of the bulb industry there.

Two factors caused the decline of the old botanical garden which was really a drug or herb garden. One was that drugs became available as standard products, and the physician no longer had to collect them himself; nowadays most drugs are synthetic. But more important was the difficulty of maintaining a complete collection. Whereas in the sixteenth and seventeenth centuries, a botanical garden was essentially a complete living collection of all known plants, this became impossible toward the end of the seventeenth century. At that time travelers were bringing back numerous plants from the tropics, and these plants could not be grown in the colder climates where the study of botany was pursued. Even though greenhouses were invented and improved, they could house only a small portion of the tropical plants that were becoming known; and since most of these were trees, they could not be grown properly. At the same time botanists became aware of the importance of dried plants, which could be stored permanently in a herbarium, and the herbarium thus took over one of the functions of a botanical garden, namely, that of a repository of plant types. Now most of the important botanical gardens have herbariums connected with them.

When in the eighteenth and nineteenth centuries other branches of botany developed—morphology, anatomy, and physiology—the relative importance of the botanical garden as a teaching collection waned. The professor of botany, who was director of the university botanical garden, became more interested in his laboratory and less in the garden. This meant that the chief gardener, or curator *(hortulanus)*, actually ran the botanical garden, and since he was interested primarily in well-grown plants and not especially in botanically important plants, the university botanical garden became a park and a display collection of attractive flowers rather than the original teaching collection of plants.

Simultaneous with the twilight of the botanical garden, the private or estate garden became important. The new merchant-aristocracy in Europe of the eighteenth century lived partly in the country, where gardens were possible, in contrast with the terrible crowding of houses in the city. Not to be outdone by the merchants, the nobility and even kings started to build beautiful gardens around their castles, where the moats were no longer required for security and defense. In many cases these estate, castle, and palace gardens practically became botanical gardens. Thus Kew Gardens were originally the gardens of Kew Palace. The famous Botanical Gardens in Buitenzorg (now Bogor), Java, evolved from the garden of the Governor-General. The Missouri Botanical Garden grew out of the garden of Henry Shaw, a retired St. Louis merchant, and even after one hundred years is still locally known as Shaw's Garden. The most recent among the American botanical gardens, Longwood Gardens, was the estate of Pierre duPont.

This new type of botanical garden has completely revitalized the old type. It is not only a collection for demonstration, research, and teaching, but it has become a service organization. This is the type that fits in our modern society.

Let me detail a few of the functions of the modern botanical garden as I see them from first-hand experience. I shall not list them in order of importance, for I believe that all of them are significant, and all should be more or less equally stressed. At least, we are trying to do this at the Missouri Botanical Garden. It is interesting that, as in the Act of Incorporation of The New York Botanical Garden, Henry Shaw outlined many of these functions, which were included in his will endowing the Missouri Botanical Garden, after he had founded it in 1859. The success and

significance of a botanical garden do not lie in its size, its endowment, the number of plants it contains, or the number of visitors it draws, but in the degree to which all functions are developed, balanced, and integrated. At least that is what I like to think, being Director of a garden that is neither the biggest, nor the best endowed, nor has the largest herbarium, nor attracts the greatest number of visitors. And now for the list:

1. The garden should contain a teaching collection of plants, demonstrating flowering specimens of the different families for the classes that are taught at the garden, for neighboring colleges, and for visitors. This collection should not be too large, for very few persons would work for weeks in the garden to become acquainted with all specimens grown.

2. It should be a repository for limited groups of plants that grow particularly well in the area and cannot be properly studied as herbarium specimens, such as horticultural varieties of crab-apples, roses, irises, azaleas, orchids, or aroids. Such groups can thus be used for intensive study by specialists. Most present-day botanical gardens are doing this, each specializing in certain groups or families of plants.

3. The garden should be attractive to the general public, meaning that all plants should be exhibited in the most beautiful park-like surroundings. Actually, every larger city should set aside one of its parks as a botanical garden under the direction of a trained botanist.

4. The garden should provide demonstrations for the home gardener. At the Los Angeles State and County Arboretum, the home demonstration gardens have proved highly successful, and in many other places the public is visiting such gardens in great numbers. There should be, for example, a city backyard garden, a patio garden, an herb, a fragrance, a Japanese, and similar gardens. In that way the visitor will see the relationship between the large collections of plants present in the botanical garden and his own garden problems.

5. One of the important functions of a botanical garden is the training of gardeners in general. This should be largely a practical training, designed to develop men who can later, either in a botanical garden or on a private estate, take proper care of the various plant materials. At present, hardly any such training is available in the United States, since the courses in horticulture given in high schools and colleges are usually more theoretical than practical.

6. In his will, Henry Shaw suggested that the Missouri Botanical Garden provide training not only for gardeners, but also for students and for the public in general. He established the Henry Shaw School of Botany at Washington University and provided for a close tie between the Missouri Botanical Garden and the School. In the same way The New York Botanical Garden and Columbia University are closely associated. This is important, for in this way the privately or municipally-owned botanical garden can also function as a university botanical garden, of which there are too few in the United States. Classes should be held for both children and adults, which will make it possible to use the rich collections of plants for the education of the public in general. The education of children is particularly important since, at present, the primary schools provide so little biological education. This can very properly be provided by the botanical garden or zoological park.

7. A very obvious and important function of a botanical garden is to serve as an horticultural center, providing information about local growing conditions, the best plants, disease and pest control, and so on. It would also be ideal to have a plant clinic to which persons could bring diseased plants for expert advice and information.

8. Research is the aspect of the botanical garden in which I am most interested. The large collections of living plant materials should be used to increase knowledge of plants in general. Instead of carrying out highly specialized research, which could be done in any botanical laboratory, research in a botanical garden should most logically center around the plant collections. There is another very good reason why a botanical garden should carry out such research. With the unprecedented increase in interest in gardening, as reflected by the enormous growth in the number of garden clubs and in the nursery business, no concomitant increase in research has occurred. The nurseries and garden-supply companies in the United States do several billion dollars worth of business each year, and the lawn and turf grass business, including greens care, approximates ten billion dollars annually. Few organizations and institutions are engaged in problems of the nursery and turf grass businesses; hence a botanical garden is the logical place for carrying out the essential research.

Let me list just a few of the problems that are of special significance to the gardener. a) There is still much to be learned about germination, especially of the horticulturally important plants. b) Problems with the rooting of cuttings and the propagation of plants in general remain as important as ever. c) Any advances in knowledge of plant growth will be helpful to the gardener in general, but advances in knowledge of problems of flowering will be particularly helpful. If we were successful in making plants flower for longer periods of time, or in having them produce more flowers, gardens would be more colorful. There are all sorts of problems in flower biology—opening and closing of flowers, pollination, fertilization—which should command the attention of botanical gardens.

9. Another very important phase in which a botanical garden should take the lead is in plant introductions and in the breeding of new and better varieties of horticulturally important plants. Each area has its own climatic problems; hence each area requires somewhat different varieties for the best results.

10. It seems to me that a botanical garden should be the center for new developments in the general field of greenhouses. The development of the Climatron at the Missouri Botanical Garden is a specific example, and we hope, in our next set of greenhouses, to introduce a number of further improvements both in greenhouse construction and operation.

I should like to close with a brief consideration of the ways in which a botanical garden can be financed. In the first place, there is the possibility that a rich person will establish and endow a botanical garden, as happened with the Missouri Botanical Garden and Longwood Gardens. A limited endowment, however, does not permit growth of the institution beyond what the endowment allows. Op-

erating costs tend to increase more rapidly than does income from such endowments; therefore, and generally speaking, we have to look elsewhere for sources of support.

The second way is by means of tax support, in which each taxpayer bears part of the cost regardless of his interest in the garden.

This difficulty is obviated by a third possibility, namely, the development of operational income from admission fees or other sources. In Europe a number of gardens are financed almost entirely by such operational income. Among these are Tivoli Gardens in Copenhagen and Planten un Blomen in Hamburg. We are presently trying to accomplish such financing at the Missouri Botanical Garden, and the public response has been quite remarkable. It may very well be possible to maintain the public gardens and greenhouses at the Missouri Botanical Garden from contributions by the visiting public. Few people object to a small contribution when they know that it is helping to maintain what they have come to see.

The Climatron at the Missouri Botanical Garden is the first fully climate-controlled geodesic dome greenhouse. It is revolutionary in greenhouse conception, both in design and operation. The dome-shaped structure has a framework of aluminum tubing, supported on a circular concrete base. In the dome the tubing is arranged in hexagonal patterns and is lined with Plexiglas set in triangular mullins which are suspended from the geodesic frame.

Its unique climate-controlled system can produce rain, mist, dry air, and almost any other kind of atmosphere required by the tropical plants that are growing in the Climatron.

Dr. Frits W. Went, Director of the Missouri Botanical Garden, developed the plan for the Climatron with Joseph D. Murphy and Eugene J. Mackey, architects. It is an outgrowth of studies made by Dr. Went while he was professor at the California Institute of Technology. The structure follows principles established by R. Buckminster Fuller, inventor of the geodesic system.

This is the fully climate-controlled geodesic dome greenhouse or Climatron at the Missouri Botanical Garden.

The R. S. Reynolds Memorial Award of $25,000 was formally presented to Mr. Murphy and Mr. Mackey, partners in the architectural firm of Murphy and Mackey, at the convention of the American Institute of Architects in Philadelphia on April 26, 1961. It is the first time American architects have won the award that was established five years ago in honor of the founder of the Reynolds Metals Company. The award, given annually in international architectural competition, is administered by the American Institute of Architects.—THE EDITOR.

THE GENE - 1960 MODEL

The following is based on a transcription of the tape-recording of the informal talk that Dr. George W. Beadle delivered at the President's Dinner during the fifteenth annual American Horticultural Congress, held in Pasadena, California, in November, 1960. Dr. Beadle, Nobel Laureate, was then Acting Dean of the Faculty of the California Institute of Technology. He is now Chancellor of The University of Chicago.

EACH OF US, you and I, started development as a single cell, the fertilized egg, which is almost microscopic. This cell doesn't look very different from a cell that gives rise to a guinea pig, an elephant, a spinach plant, or a corn plant; but somehow it must know what it's going to do, because it doesn't grow into an elephant, it doesn't grow into a guinea pig, it grows into a person. It doesn't grow into just any person, it grows into a very specific person, you or me. And we're all different.

The egg is a spherical cell about three-hundredths of an inch in diameter. The great bulk of it is cytoplasm.* Inside the cytoplasm is a nucleus, and inside the nucleus are chromosomes, forty-six of them. Inside the chromosomes are genes, and these genes collectively carry the information that says what the egg is going to do. And that is what my subject is about.

Because I shall discuss the genetic material that is inside the nucleus of the egg, I don't want you to think that I think the cytoplasm is unimportant. It is definitely not unimportant; it is indispensable. Not only is it indispensable, but it is very specific. No nucleus by itself can develop into an organism. For example, if we take the nucleus out of the egg of a frog such as the grass frog, *Rana pipiens,* and by micro-surgery put into that egg a nucleus from a related frog, *Rana sylvatica,* the egg will not develop. If we per-

*The living matter of a cell is called protoplasm. Part of the protoplasm is organized into a body of definite form, the nucleus. The rest of the protoplasm is called cytoplasm. Editor.

form the reverse transplantation and put *Rana pipiens* into *Rana sylvatica,* it will not develop. These are not compatible. But we can take the egg nucleus from *Rana pipiens* and put it into an enucleated egg of the same species—and it will develop. The cytoplasm must be specific.

We know quite a bit about the form and structure of the cytoplasm. We know quite a bit about how cytoplasmic characteristics are transmitted. We know they are transmitted from generation to generation.

In addition to a nucleus and a cytoplasm, the egg obviously has to have a very specific environment. In our own case (human cytoplasm) there must be a very specific environment both physically and chemically in the early stages. It must be an environment in which raw materials are present because, compared to the egg, we are very large; and in order to get where we are, we have used a lot of raw material which was converted into us. This is the food we eat.

In addition to a physical and chemical environment, and food material, we have another kind of environment which is important, particularly in our species because it makes us different from any other species on earth. We have a cultural environment which feeds information into our brains, where it can be stored, rearranged, and retrieved. This is what our species has accumulated in extra biological knowledge over many, many generations; it is added to and accumulated with every generation. This is the basis for all our culture, religion, art, literature, music, technology, and science, and we are the only species on earth to accumulate cultural inheritance to any significant degree. Each of us has a tremendous store of knowledge in his or her brain.

If you were to write down everything that is stored in your brain, including everything that is in your subconscious mind, how much would it be? You can't even estimate how much. A lot of it is nonsense, but it's still information of one kind or another. There's also a tremendous amount that's part of you, an inseparable part of you; you acquired it in an extra-biological way. It isn't inherited through any set of directions in the egg; it came from the outside.

I want to ask, first of all, how did the information in the nucleus of the egg of a person, or of a carnation, or of a guinea pig get there, and how is it transmitted to the next generation? This is just another way of asking about classical genetics.

My second question is: How are these directions in the egg nucleus written—what is the language of the gene? As a result of quite recent developments, we know quite a little about how these directions are written.

The third question I'd like to consider is: How do we replicate this information with each cell division as it must between the egg of one generation and the egg of another generation? It is quite a feat, for there are fifteen to thirty or more successive replications of all the information that is necessary to make a person out of an egg, given a proper environment and food.

The fourth question is: How do we use this information to convert food into us—how do we make use of these specifications?

And my fifth question: Do these specifications ever change during transmission from one generation to another? This is another way of asking: Do mutations occur?

If I were to give you strips of laboratory filter paper to chew for a few seconds, some of you would be able to taste the phenylthiocarbamide with which the paper is impregnated; others would not be able to taste it. There are not two kinds of paper—there are two kinds of people, because of the different sets of directions in the cells of the egg nucleus.

Each one of us has two parents, so we get two sets of directions or messages. The messages can be of two kinds, so four kinds of people are possible. We can get a message from our mother saying, "I can taste phenylthiocarbamide," and a similar message from our father, in which case we are pure tasters of the substance. We can get a message from our mother saying we can taste and from our father saying we can't. This is another way of expressing that one message is dominant, the other recessive. We are then not pure tasters. We can get a message from our mother which says we cannot taste and from our father which says we can, and again we are not pure tasters. And finally we can get messages from both parents saying that we cannot taste. We are then pure non-tasters.

These messages or directions are written in a code that is actually simpler and more efficient than if they were written in English. It is a four-symbol code.

In the chromosomes of each cell are two kinds of molecules: protein molecules that are made of twenty kinds of amino acids strung together in long chains in various sequences; and molecules that are made of deoxyribonucleic acid or DNA. The latter are long molecules, and the units are of four kinds strung together in various orders. We think that DNA is the significant code—the primary code in carrying hereditary information—because we can transfer genetic specifications to a bacterium through chemically pure DNA. We can throw the protein of the bacterium away, save the DNA, and put this DNA in a new bacterium, causing it to change genetically in a predictable way.

We can do the same with viruses. Some viruses contain the same two kinds of molecules, protein and DNA. One of the smallest DNA viruses (a virus that grows in bacteria) has a single molecule of DNA in its core, which is inside a protein coat. During the infection process this single molecule of DNA enters the bacterial host cell on which the virus grows and the protein coat stays outside, so that the gap between generations of viruses in this case is bridged by a single molecule of DNA. Again, we can throw the coat of the virus away and infect the bacterium with a single molecule of DNA. This tells the bacterial cell how to make more DNA of the kind the virus wants and how to make a protein coat to put around the molecule of DNA and thus make a new virus particle. As many as two hundred daughter viruses may be produced twenty minutes after the infection. In bacteria and in viruses, DNA obviously must carry the direction from one generation to the next. Since we have both these substances in the nuclei of our cells, we are pretty sure that the code in us is written in DNA just as it is in lower organisms.

There are four kinds of units of these long DNA molecules, and we can put them in any order to spell out a message. Actually in most organisms it is a double molecule; the nucleic acid chains are paired to form a double chain somewhat like a ladder. The code then consists of

the sequence in which we put the units together. How many of them do we have in a single cell of our body? In the nucleus of the fertilized egg there are about five billion pairs of units arranged in a specific way. With the amount of DNA in a single human cell, we could write directions for all the organisms, other than man, that have ever evolved on earth, all those that exist now, and all those that are going to evolve, and we would have used only a very small fraction of the total. We would still have enough left—excluding nonsense messages—so that all the two and a half billion people on earth are different. Each one has a different sequence—except for identical twins.

How much information, in more familiar terms, does this amount to? If we were to put the DNA code in the molecules of a single cell into English letters, using an efficient code unit—unit 1 can be the letter A, unit 2 can be the letter B, and so on—and started translating the DNA of a single cell into a book, we would use only one tenth of one per cent for the whole book. With the total DNA of a single cell we could therefore encode about one thousand printed volumes of information.

To give an idea of the miniaturization achieved by this code, I can say that if we were to take DNA and string it out over the head of a pin, one layer thick—back and forth like matchsticks—we would get the whole five feet of DNA on the head of a pin and would have used only one half of one per cent of the head of the pin.

How do we make copies of these instructions? Remember, the egg cell that you started from has the equivalent of one thousand volumes of directions. You're going to reprint these thousand volumes each time a cell divides, and you're going to have to do this successively fifteen or thirty or more times to get from the egg to the egg of the next generation. This is comparable to a typist copying fifteen to thirty thousand volumes—and not making many typographical errors in the process.

How are DNA molecules reproduced? This involves a very special process discovered by Watson and Crick after they had worked out the structure of DNA. DNA is the only large molecule we know of that can direct the synthesis of more molecules like itself. All living things reproduce living things like themselves out of raw material of diverse kinds. People make little people, guinea pigs make little guinea pigs, spinach plants make little spinach plants. DNA is the only molecule that can make little DNA molecules—but the little molecules are the same size as the parental ones. It does so by an exceedingly simple mechanism, so simple it is almost unbelievable. The DNA is a double molecule. Paired with each unit 1, there will always be a unit 2, and with the unit 2 a unit 1, with the unit 3, a unit 4, and with the unit 4, a unit 3. This means that the message of one chain is complementary to that of the other chain. If we know the message in one pair, we shall know the message of the other by this law of complementarity. In other words, one half of the molecule knows what the other half ought to be. During cell division the chains come apart. Each single chain then serves as a template to pick up the units out of which a new chain is made. This we believe is the molecular basis of all biological reproduction.

How do these pieces know that they are supposed to pick up their complements? They know because the chemical structure is such that they will fit only their complements. Is there evidence that this is true? Yes, we can put isotopic labels, for example, radioactive phosphorus, in them in such a way that we can tell an old strand from a new one. In this way we find that they do just what the book says. Or we can supply heavy nitrogen and thereby make heavy DNA molecules in a bacterium. If we grow the bacterium in a heavy nitrogen medium for many generations, all the DNA molecules will become heavy. Now if we let a bacterium with heavy molecules reproduce just one generation in the presence of light nitrogen, the two halves that are heavy will come apart and acquire partners having light nitrogen. We should then have double molecules with one chain heavy and one chain light. They will be hybrid molecules. They will be half way between heavy and light in density. After one more generation in light nitrogen, the hybrid molecules should come apart and construct partners containing only light nitrogen. Therefore, after two generations we should have two kinds of molecules in equal numbers—hybrid and light. Very ingenious experiments show that this is what happens.

This doesn't prove the hypothesis. It just says there's agreement. Nature could find another way of doing it to fool us—if she were unkind. We don't like to think nature would do this, but one must be suspicious as a scientist. Therefore we like to have evidence of an independent kind.

There is in fact such evidence, and it is very dramatic. It comes from the studies of Professor Kornberg and his associates at Stanford University. They have shown that a test-tube solution of four DNA units, in a proper buffer, with magnesium ions and catalytic protein molecules is capable of producing DNA molecules if "primer" DNA molecules are added to the system. Without the primer, nothing happens immediately. But if a few molecules of DNA are added, this DNA starts replicating. This DNA can be of a person, a bacterium, or a virus—it doesn't matter. How can we tell that it behaves in the Kornberg system as it does in our cells? We can tell this if we know the composition—the message in the DNA—that we put in the tube. We can't do this directly, but we can approximate it, because some DNAs have more 1-2 units and other DNAs have fewer 1-2 units in relation to the 3-4 units. We can determine the ratio of 1-2 units to 3-4 units of the primer molecules and see if the product we get has the same ratio. It has. If we drip a low ratio primer in the test tube, we get a low ratio product; if we drop a high ratio primer in, we get a high ratio product.

If the test-tube solution without a primer is allowed to stand long enough under the right conditions, DNA molecules are formed of a kind that are not known to occur in nature. These are DNA molecules that do not contain any 3-4 units. The units are arranged in a strange way—1-2-1-2-1-2- in one chain and 2-1-2-1-2-1- in the other. This is an artificial DNA made spontaneously in the Kornberg test tube. If it is used as a primer in a fresh system, it will immediately start priming formation of more DNA *like itself*. The product DNA will contain no 3-4 units. The Kornberg studies have greatly strengthened the conclusion that DNA replicates as postulated by Watson and Crick.

(Continued on page 138)

DUCKWEEDS IN TEST-TUBES

By WILLIAM S. HILLMAN

Dr. Hillman is Assistant Professor of Botany at Yale University, New Haven, Connecticut. This article is partially based on the talk entitled "Test-tube Studies on Flowering," that was given at the symposium on "Fundamental Developments in Plant Growth" sponsored by the Torrey Botanical Club and AAAS Section G at the December, 1960, meeting in New York of the American Association for the Advancement of Science. Dr. Hillman's own work with the duckweeds, supported by the National Science Foundation, has been concerned with flowering and with red light requirements for growth. Most of the other observations mentioned below are by earlier investigators.

DUCKWEEDS, of no account in horticulture or agriculture, are usually encountered in either of two places: in botany texts, where they are noted as the smallest of the flowering plants, and floating on ponds or quiet lakes, their natural habitat. Here they may make up in numbers what they lack in size. Each plant of the common genus *Lemna* consists of an oval frond less than a quarter-inch across, with a hair-like root an inch or so long; but a few such plants, continually budding off new ones vegetatively, may in a few weeks of summer cover the water with food for ducks and muskrats, and trouble for fishermen.

It has been said, and duckweeds help to prove it, that nothing is truly useless—even from the narrow human point of view (excuding, for instance, that of the ducks). Like the tiny fruitfly *Drosophila,* so valuable for research in genetics, the duckweeds might well have evolved for the benefit of biology. These tiny plants are helping the plant physiologist to ask and answer many questions on topics such as nutrition, flowering, and the various effects of light on growth.

Over thirty years ago it was discovered that single duckweed fronds could be freed from bacteria and algae, by being rinsed in disinfectants, without destroying their ability to produce new fronds when placed on a sterilized nutrient solution. Since each group or "colony"—an older plant with several descendants still attached to it—soon falls apart, aseptic culture can be carried on by transferring small colonies to new solutions, all by standard bacteriological techniques as shown in the first illustrations. These techniques combined with the two most obvious duckweed characteristics, small size and rapid growth, make it possible to conduct experiments that would be difficult or impossible with most other plants.

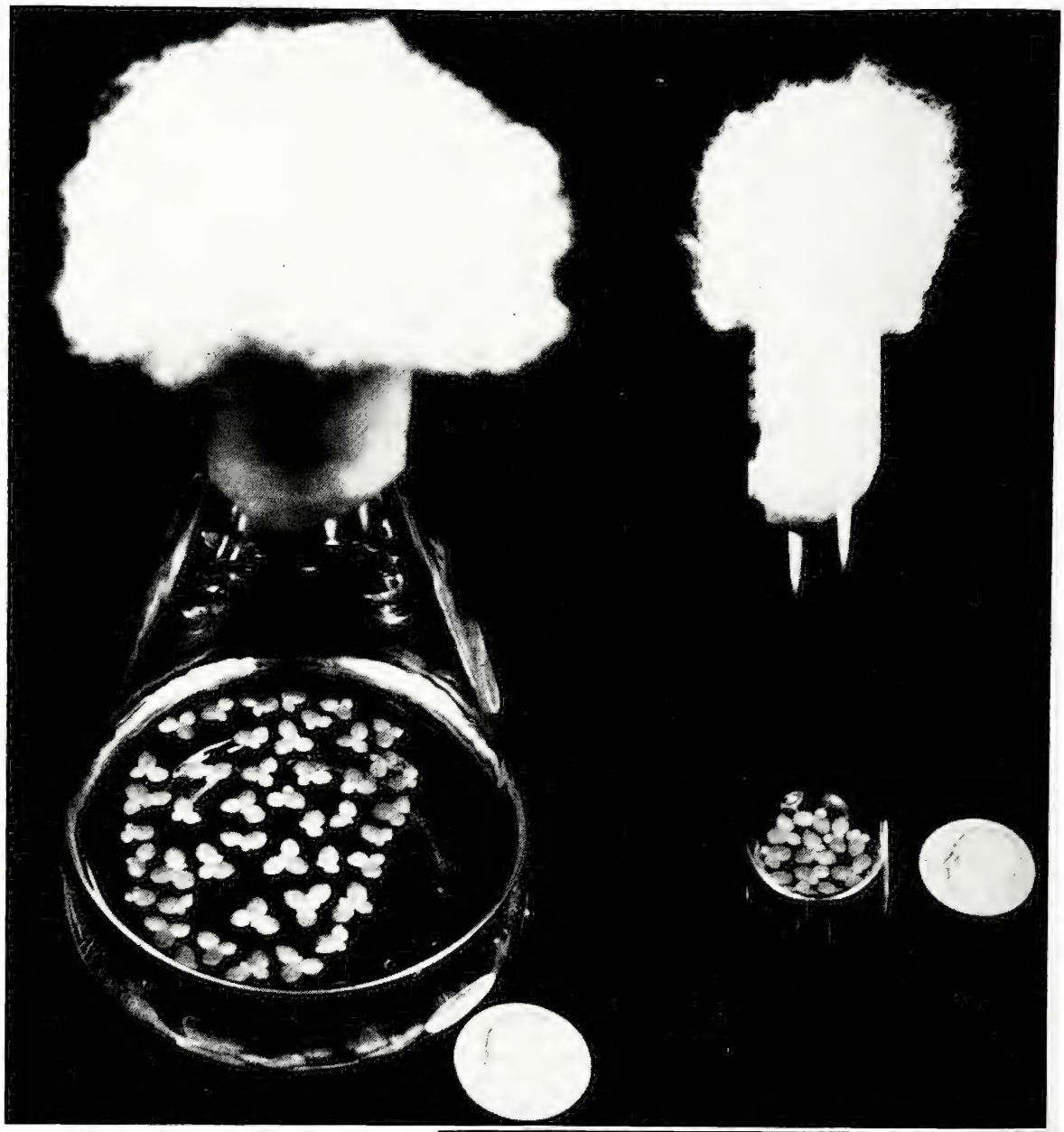
Aseptic cultures can be grown not only on purely mineral solutions, but also in the presence of organic substances such as sugar without fear that the final results may be due to the effects of bacteria or other organisms growing on the organic materials. Another advantage comes from the duckweed's ability to continue indefinitely producing new plants vegetatively in a population, although a particular individual will produce at the most twenty others before it dies. Hence, an infinite number of experiments can be done with plants descended vegetatively from one original plant—a single clone. This procedure gives much less variation than using plants raised individually from seed, since all plants in a clone are genetically identical. There are other advantages of working with aseptic duckweeds. With plants and culture vessels so small, accurate control of light and temperature and the performance of experiments that involve many treatments become much easier than if one were working, say, with tomato plants. And at least one measurement of growth can be obtained without disturbing the plants in any way—by simply counting the number of fronds at various intervals and calculating the rate of increase.

One of the questions that aseptically cultured *Lemna* helped to answer years ago was whether or not plants need traces of organic substances, besides minerals, for normal growth. Some experiments had suggested that they might, since only the addition of manure or peat extracts made normal growth possible in certain nutrient solutions. These effects were interpreted as due to "auximones"—hypothetical compounds believed to be necessary for green plants just as vitamins are necessary for animals and men. A major reason for developing aseptic culture techniques for *Lemna* was that these would make it possible to exclude the small amounts of "auximones" that might be produced by a few bacteria in mineral solutions.

When this was done, in carefully balanced mineral solutions, it became clear that no specific organic substances were required. And *Lemna* plants grown aseptically under entirely inorganic conditions were actually nutritionally superior, as vitamin-sources for animals, to plants grown in media rich with organic supplements.

Notwithstanding this, and similar work with other plants, some advocates of "organic gardening" still seem to support the discarded "auximone" theory of plant growth and plant nutritional values. Further work, again with *Lemna* as well as with other plants, has indicated that when plant growth *is* improved by traces of organic matter, it is because many substances can "chelate" or form complexes with various metallic nutrients. Such chelate complexes, depending on the specific situation, may make the metals either more easily taken up by the plant (as is true of iron) or less so. But such chelating effects are highly unspecific in being exerted by many common compounds, and bear no relation to the hypothetical vitamin-like "auximones."

Let us turn from mineral nutrition to the roles of light in growth and development. One way of studying the effects of light is to exclude it entirely and to try to grow plants in total darkness. Of course, if only minerals are supplied, the plants will soon starve to death; certainly the best known role of light is in photosynthesis, by which sugars, which are both fuel and building material for growth, are



Upper.

Aseptic cultures of *Lemna perpusilla* in flash and test-tube.

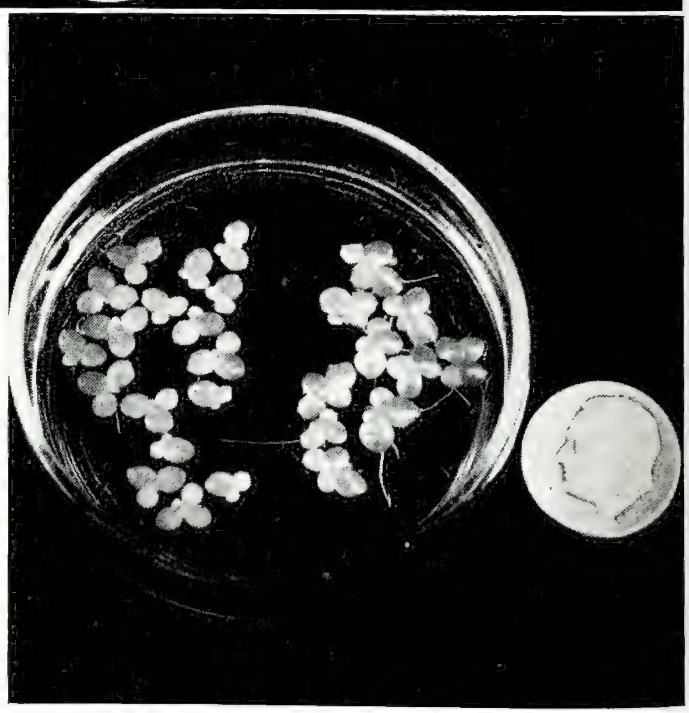
Lower.

***Lemna perpusilla* (left) and *L. gibba* (right) in a small Petri dish. Note that the right-hand group is composed of forty individual plants, or fronds, grouped in ten colonies.**

produced. Light is also required for the synthesis of the chlorophyll that is involved in photosynthesis. But suppose one feeds sugar to the plants; will they then grow in total darkness?

Aseptically cultured duckweeds again provide the easiest test system, and the answer to the question is both yes and no. Certain clones of some species grow almost normally in absolute darkness on mineral solutions supplemented with sugar. Although they are white, rather than green, the size, shape, and growth rate are approximately normal. However, certain other clones die under the same conditions. What other substances do these clones require in order to survive and grow in total darkness? The answer here might indicate what else light does besides supplying energy for photosynthesis. Unfortunately, the results to date are of little help. Some light-requiring clones will indeed grow, very slowly, with yeast extract added to the medium. But yeast extract contains many different chemical compounds, and the particular combination responsible for even this small growth is unknown.

Another way of examining the light-requiring clones is



to see how much and what kind of light they need. This approach draws on work which has been done on other plants to obtain answers to different questions. It has been known for years that most seedlings grown in the dark from seeds that have germinated in darkness develop abnormally, with extremely elongated stems and tiny leaves, before they die of starvation. Although a high light intensity for considerable periods is required to prevent starvation—that is, to satisfy photosynthesis, brief flashes of dim light are all that is needed to prevent this abnormal development (etiolation). In recent years plant physiologists at the United States Department of Agriculture, and elsewhere, have found that the most effective color of light in preventing etiolation is red; further, the effects of a red light exposure are annulled if the plant is then quickly exposed to "far-red" light, of wave-length (7300 Å) just slightly longer than true red (6600 Å). Many other plant processes are also strongly affected by this "red, far-red" system; and in no plant is this more evident than in the light-requiring *Lemna* clones, to which we now return.

In total darkness, on minerals and sugar, the plants stop reproducing vegetatively and soon die. However, less than five minutes of dim red light every few days will permit growth to continue, although the new plants that are produced remain white. A burst of growth follows each light treatment, then the growth rate falls again until after the next. If the red light is followed immediately by far-red (again, for five minutes or less), no growth occurs. But far-red itself causes no permanent damage, since a sequence of brief treatments red, far-red, red gives good growth again. As has been pointed out for other plants, the red, far-red system thus acts like an on(red)—off(far-red) switch. But for these particular *Lemna* clones, it is a switch of life or death.

No single chemical substance has been found that will remove this non-photosynthetic red light requirement. A few of the newer plant growth regulators, including gibberellin, have also been tried, but without success. Kinetin is effective in causing several bursts of growth, but probably not over longer periods. Thus we remain ignorant of what biochemical system is connected and disconnected by the red, far-red switch, although duckweeds may eventually help to identify it.

Flowering, representing sexual rather than vegetative reproduction in plants, is also affected by light, through photoperiodism. By photoperiodism is meant the control of reproduction and other aspects of development in many plants (and animals) by the length of the daily exposure to light. Some plants are "short-day" plants—that is, they flower only if given *less* than a certain number of hours of light per day. Many others are "long-day" plants, requiring *more* than a certain number of hours of light per day to set flowers. This "certain number of hours," known as the critical day-length, may vary greatly from plant to plant. Still other plants are entirely indifferent to day-length with respect to flowering, although all are affected by it in some ways.

Short-day plants can also be regarded as "long-night" plants, since flowering in most of them is prevented not only by long light periods, but also by simply interrupting, with a flash of light, a long night which would otherwise lead to flowering. In the same way, long-day plants can be regarded as short-night plants. The discovery that this effect of light flashes was another red, far-red phenomenon—red being the most effective color for interrupting a long night, and far-red annulling the effect of red—has been of great importance in unifying many studies of light effects on plants, and in directing attention toward the underlying physiological processes.

Although photoperiodism has been known for some forty years, the first observation of photoperiodism in a duckweed was published only six years ago by an investigator in West

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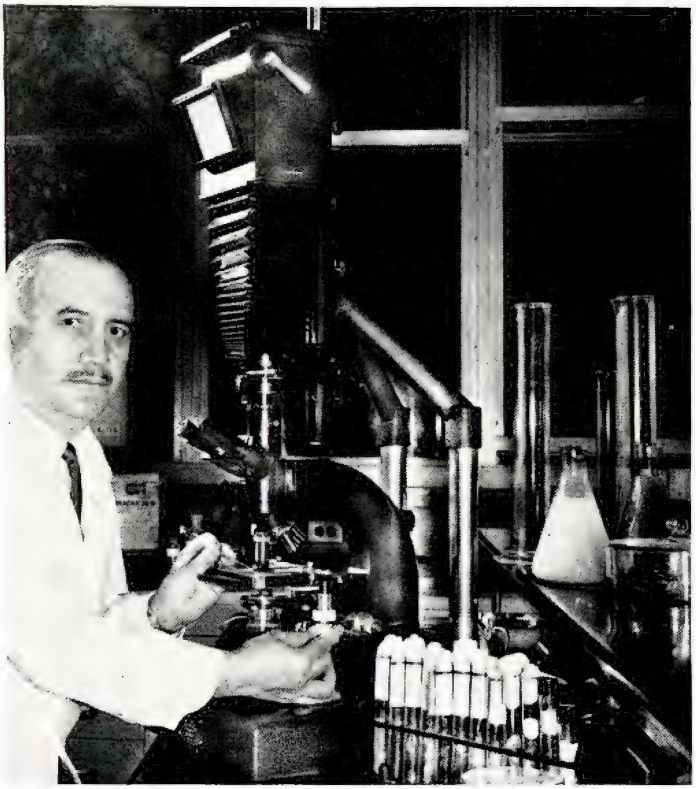
Magnified view of *Lemna gibba* from above shows flowering. Arrows indicate protruding anthers.

THE PLANT PATHOLOGIST AT THE GARDEN

By DOROTHY EBEL HANSELL



Dr. Pirone adjusts the Leitz microscope and reflex 4 x 5 camera before he takes a photomicrograph of fungus spores. This elaborate apparatus was presented to the Garden by the American Agricultural Chemical Company.

RECENTLY I was asked, "Just what does Dr. Pirone, the Garden's Plant Pathologist, do?" to which I replied, "He looks after the health of the living plant collections. That is quite a responsibility, since there are eight thousand or more different kinds of plants in the Garden, and plants are subject to different diseases just as human beings are. Dr. Pirone takes a sick plant—or the diseased part of a plant—to his laboratory, diagnoses the cause, and prescribes methods of treatment to prevent the spread of the disease. In general, a plant that has succumbed to a disease cannot be cured. It has no circulation of blood—no blood stream—to carry away wastes and to introduce medicines. Dead cells are dead. In other words, Dr. Pirone as a plant pathologist can prevent but not cure plant diseases."

This brief conversation made me pause—to ponder what falls within the province of the plant pathologist at the Garden. Readers of *The Garden Journal* may be interested in learning what my conversation with Dr. Pirone revealed.

Dr. Pirone anticipates and prevents outbreaks of diseases and insect attack by setting up a schedule for regular, periodic spraying. The Montgomery Conifer Collection and the Pinetum, for example, are continually checked for mites and scale. The Rose Garden is sprayed at least twenty times a year. More than twenty-five thousand gallons of spray materials are used in an average season at The New York Botanical Garden. When any tree or shrub on the grounds or any of the tropical plants in the greenhouses show signs that they may be affected by some blight, Dr. Pirone finds out what the trouble is and prescribes accordingly.

Controlling the insects and diseases that may attack the thousands of bushes in the Rose Garden is one of Dr. Pirone's duties. Here he watches as an employee of the Garden applies a combination fungicide-insecticide.

This large elm has succumbed to the Dutch elm disease, despite spraying with DDT, an insecticide which is supposed to kill bark beetles that spread the causal fungus. Insert. Dr. Pirone explains to John Swan, Foreman of the Arboretum at The New York Botanical Garden, how the Dutch elm disease spreads, while Martin Loughlin marks the tree with a large X so that it can more easily be spotted for removal during the winter.

George Griffin, Arboriculturist of the Department of Parks of the City of New York, for the Borough of Queens, (center) and another employee of the Park Department look on while Dr. Pirone cuts away infested bark to uncover the larval stage of the American plum borer. This is a serious pest on London planes in New York City.

Since The New York Botanical Garden does not have an entomologist, Dr. Pirone combats insects as well as diseases. This necessitates his keeping informed in that area as well as in his own discipline of plant pathology. His services are not confined to insects that attack plants but extend to the control of household pests, such as ants, termites, and roaches, for Dr. Pirone comes to the aid of residents of the city as well as assisting the members of The New York Botanical Garden, gardeners, florists, nurserymen, and the Department of Parks of the City of New York. Many of the calls for help come by telephone; others are received by letter from all over the United States, and occasionally some bear the post mark of foreign countries. Answering all these calls consumes quite a lot of the Plant Pathologist's time, but Dr. Pirone also devotes himself to research, investigating the cause and control of diseases of ornamentals, and when no control measure is known, he endeavors to develop one.

Relatively few plant pathologists concentrate their efforts and energy on diseases of ornamentals as compared with those who are concerned with the diseases that afflict cereals, fruits, and vegetables.

Dr. Pirone has a well-equipped laboratory in the Research Laboratory of The New York Botanical Garden, in which he carries out his studies and investigations. Just as the medical doctor examines his patients, studies their histories and symptoms, before deciding what treatment and medicine to prescribe, so does the Plant Pathologist. He must be familiar with the many diseases to which plants are susceptible—from the brown patch on lawns, the nematodes that infest chrysanthemums, the mildew that troubles lilacs and roses to the destructive and widespread Dutch elm disease *(Ceratocystis ulmi)*. Plant diseases are caused by fungi, bacteria, viruses, and nematodes, and the plant doctor must be able to recognize the symptoms that are brought on by these different agents in order to recommend the proper remedy. He has a whole arsenal of chemicals at his disposal, but he must know the specific chemical that is effective against a specific problem.

Dr. Pirone checks the flow of natural gas from tank to the roots of young trees that are being subjected to this substance, as John Walther, a Garden employee, stands by.

The branch of a young Norway maple is being inoculated with a fungus originally isolated from a dying tree on a New York City street. After Dr. Pirone inserts the fungus into the wound made with a sharp scalpel, he covers the fungus with moistened cotton and then with aluminum foil. If the fungus is a parasite, the branch will soon be invaded and will die within one to three months.

The first large-scale tests on feeding shade trees through their leaves were conducted by Dr. Pirone in cooperation with the Department of Parks of the City of New York. Dr. Joseph Kuc, second from the left and presently a professor at Purdue University, was Dr. Pirone's assistant in this pioneer work.

In recent years Dr. Pirone has conducted research on the effects of natural gas on plants, of gibberellic acid in accelerating plant growth, of maleic hydrazide in retarding plant growth. Dr. Pirone was the first to report on the use of maleic hydrazide in retarding growth on California privet. He was also the first to ascertain that through air-layering roots can be made to develop on the stems of the London plane within three weeks. This finding was important, because the London plane is one of the most extensively planted trees on the streets of large cities. In earlier years, in cooperation with the Department of the City of New York, Dr. Pirone successfully carried out investigations on foliar feeding. These were the first large-scale tests of feeding plants through their leaves.

This spring Dr. Pirone, also in cooperation with the City's Park Department, started an investigation of the cause of a blight that has made its appearance on *Gingko biloba* in various sections of New York City during the past year. The disease is accompanied by scorching and browning of the leaves. While the Park Department has five arboriculturists—one for each of the Boroughs—it does not have a plant pathologist on its staff. So the Garden's Plant Pathologist is frequently called upon to assist in diagnosing diseases and in recommending treatment.

Dr. Pirone, on his own time, serves as a consultant to the United Nations, to General Foods, to members of the American Gas Association. He contributes to magazines and newspapers, and is author of *Modern Gardening, What's New in Gardening, Tree Maintenance,* and co-author with the late B. O. Dodge and Harold William Rickett of *Diseases and Pests of Ornamental Plants.* The third edition of *Diseases and Pests of Ornamental Plants* was completely revised by Dr. Pirone for publication by The Ronald Press in 1960.

DUCKWEEDS (from page 133)

Berlin. Since that time, I have devised methods for rapid and accurate experiments on the photoperiodic control of flowering in several species of *Lemna.* If this work succeeded only in demonstrating already well-known phenomena under elegant, aseptic conditions, it would not be of more than passing interest. However, it seems to provide new tools toward the investigation of photoperiodism and perhaps the red, far-red switch as well. But before discussing the results, it would be well to digress for a moment to consider what flowering in a plant as tiny as *Lemna* means.

The duckweeds are true flowering plants (angiosperms) in good standing, but the flower, in common with other structures of these plants, is reduced practically to the bare essentials. It consists of two stamens and a single pistil, and each frond bears only a single flower in its lifetime. Several of these gorgeous blossoms are shown, highly magnified, in the second illustration (of *Lemna gibba,* one of the larger species). In experimental practice, one does not even wait for the external emergence of the flowers. Cultures are started with a single non-flowering colony (three or four fronds) and allowed to grow for six to eleven days under the various conditions to be studied. By this time each flask or tube contains forty to eighty fronds. Under a low-power microscope, each frond is rapidly cut to see whether or not it contains a young bud, and the percentage of the total number containing buds is used as a measure of the intensity of flowering. Under some conditions, values of seventy per cent or over can be attained in a week. This, then, is the basic form of the experiments.

The most interesting results so far, shorn of a history of fumbling experimentation, are easily summarized. Clones of two species, *Lemna perpusilla* and *Lemna gibba,* showed very different flowering behavior when they were growing in a standard mineral solution, or in that solution with sucrose. *L. perpusilla* flowered in all day-lengths, while *L. gibba* did not flower in any. Then it transpired that the addition of any of several strong chelating compounds—for example, the widely-used "versene" (EDTA)—altered the responses of both plants. *L. perpusilla* became a strict short-day plant, flowering best with ten hours of light per day or less; *L. gibba* was made to flower as a long-day plant, with sixteen or twenty-four hours of light per day, but not, for example, with eight.

Here were two plants that under the original conditions did not show photoperiodism. The addition of chelating agents, known to affect the biological activity of many metals, made both of them photoperiodic, though in different ways. One explanation might be that in the first condition certain metals were present that inhibited photoperiodism, even though the plants grew well. This guess now seems more than a guess; with special care taken to purify the water and other substances used, these plants appear photoperiodic even in the absence of the chelating agents. Further, various metals can now be tested by adding them back to such purified solutions. At least two, copper and mercury, appear to be relatively specific inhibitors of photoperiodism. That is, in minute amounts (less than one part per million) they prevent the response to day-length but have little effect on general growth processes under these conditions.

These observations—if further research confirms them—should help advance our understanding of photoperiodism, since specific inhibitors for a process often make it possible to determine its underlying mechanism. Besides its interest in terms of fundamental biology, such understanding will eventually have great practical consequences, leading to a greater control over all aspects of plant growth than any now possible.

These are some of the ways in which duckweeds have helped and are helping botanists to learn about the growth and development of all plants. Whether every single observation made with these plants will apply directly to the more familiar plants that feed or clothe us, or give us pleasure, is uncertain. But there is little reason to doubt that, by and large, the basic processes are similar in all species. It is the rapidity, convenience, and accuracy with which these processes can be studied that has given the duckweeds a third habitat besides the botany textbook and the quiet lake—the shining glassware of the modern physiology laboratory.

BARBERRIES (from page 125)

Korean barberry (it comes from Korea as its name indicates) grows about eight feet tall, and has arching branches and pendulous clusters of rounded fruits. This worthy plant is being grown by several nurseries.

The other, *B. gilgiana,* popularly called the wildfire barberry because of its red autumn color and bright red fruits, is a native of western China. Introduced for the first time by the Arnold Arboretum in 1910, it has been of interest only during the last few years when people have become convinced that they should not grow the rust-carrying barberries. Our original plant, still a perfect specimen after fifty years of growth, is ten feet tall and ten feet in diameter. Unfortunately it was listed by only one nursery in the last edition of *The Plant Buyer's Guide.*

These, then, are the most important of the many barberries to be considered for lower New York. Certainly the novelty of the group has worn thin, but recent varieties are adding interest to it. Also, with more and more emphasis being placed on "low plants" and "low-maintenance gardening," where can the home owner find such an interesting, diversified group as the barberries, requiring no pruning and no spraying for pest eradication? Ponder that one!

THE GENE (from page 130)

How is DNA information translated? This appears to occur by way of another kind of nucleic acid called RNA (ribonucleic acid). Ribonucleic acid is made of 4-units and is believed to be constructed by using DNA molecules as templates by a direct copying process. The resulting RNA molecules are then thought to move from the nucleus to the cytoplasm, where they are incorporated in submicroscopic structures called ribosomes. There they presumably serve as templates against which amino acids are put together to make proteins. Perhaps I can use an analogy that will make this understandable. RNA is a kind of information tape, much as a street with a series of houses is an information tape for the use of the mailman. The mailman has a bundle of letters with house numbers on them, and he delivers the letters to the houses with corresponding numbers. The amino acids do the same. Small pieces of coding RNA molecules are attached to the twenty kinds of amino acids. Each kind of amino acid has its own RNA code. These tagged amino acids then move along the RNA "street" until they come to the proper RNA "house" number. In this way they find a proper sequence just as the postman lines letters up in proper sequence along the street. Properly aligned, they are joined through peptide linkages to form proteins. Hemoglobin protein molecules, for example, contain six hundred amino acids each, arranged in a specific way designated by DNA.

What about mistakes? They are like typographical errors. DNA is an interesting molecule in the sense that it doesn't care what information it contains—it will replicate faithfully whether its information makes people, rabbits, or nonsense. When the instructions come out wrong, the individual who carries them is likely to be biologically less fit; that is, in a statistical sense, produces fewer than the average number of reproductively effective offspring. Over a larger or smaller number of generations such lines of descent disappear. This is what we call natural selection. This is somewhat like a typist with a monitor—throwing away all the copies that carry mistakes.

There are favorable changes in DNA as well as unfavorable ones in the above sense. The unfavorable ones are eliminated by natural selection; the favorable ones are pref-

Berberis gilgiana

erentially multiplied and replace the original. In this way we get new kinds of people, new kinds of spinach plants, new kinds of carnations. This is believed to be the basis of all organic evolution. One important point I wish to make is this: mutations, like typographical errors, are not good or bad in an absolute sense. Thus, if in typing the word *now,* I change the "w" to "t", I get *not. Not* may be a good word or a bad one, depending on the context. This is true with DNA messages in much the same sense. Genes are not good or bad in any absolute sense, but only in terms of the context. And there are two kinds of contexts for instructions for development—a genetic context and an environmental context.

Let me illustrate the environmental context. A hemoglobin molecule contains six hundred amino acids put together according to DNA instructions. The DNA instructions are sometimes altered. In one of these altered forms they specify a valine instead of a glutamic acid in two homologous positions in the molecule. The result is S-hemoglobin. If one has S-hemoglobin, the result is likely to be fatal, for blood cells containing only S-hemoglobin have a short life and the oxygen carrying capacity of the blood is dangerously reduced. If one has instructions for both normal and S-hemoglobin, the result is that both kinds of hemoglobin are present in each red blood cell. In this case the result is only slightly disadvantageous. One can say that the gene specifying S-hemoglobin is an unfavorable one. However, if one lives in a part of equatorial Africa where malaria is present, having a fifty-fifty mixture of normal and S-hemoglobin appears to be advantageous, for such persons seem to be more resistant to malaria than are persons with all-normal hemoglobin. The answer to the question, is the gene that specifies S-hemoglobin unfavorable, clearly depends on the environment.

A gene that makes a bacterium resistant to penicillin is favorable to the bacterium as long as the penicillin is present in the environment. But if no penicillin is present, the same gene is unfavorable, for the bacterium that carries it reproduces less rapidly under such conditions than do its relatives that are susceptible to penicillin. Again, whether the genetic message is good or bad depends on the environmental context. Other examples show equally clearly that the genetic context, too, may be decisive.

BOOK ORDERS

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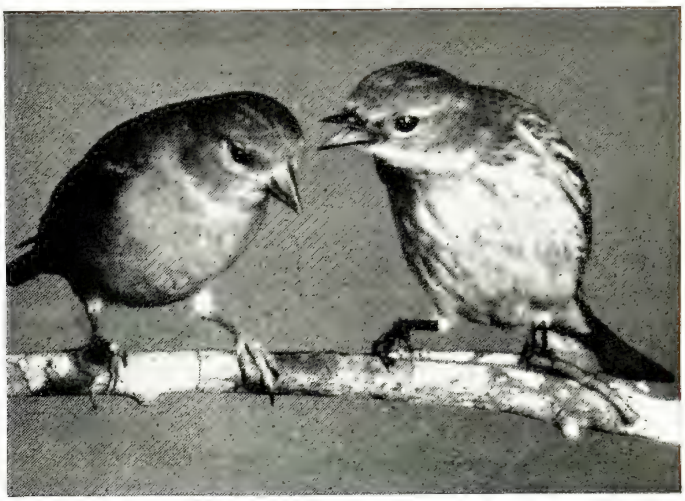

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BRIEF NOTES ON RECENT BOOKS

By ELIZABETH C. HALL

Miss Hall is Sarah Gildersleeve Fife Research Librarian of The New York Botanical Garden.

FRUITS, VEGETABLES, HERBS AND NUTS

A FRESH HERB PLATTER. Hogner, Dorothy Childs. 237 pages, illustrated, indexed. Doubleday and Co., Garden City, N. Y. 1961. $3.95

Nothing dull about this bonanza for the gourmet. Mrs. Hogner knows intimately the idiosyncrasies of the herbs she grows and writes about so vividly. The attractive planting plans and diagrams for combination vegetable, herb, and salad bowl gardens are intriguing. The flavor charts, recipes, and instructions for freezing and drying are all excellent.

THE HERBALIST; MEDICINAL PLANTS, PLANT VITAMINS AND MINERALS, BEVERAGE TEAS, SPICES, AND FLAVORING HERBS; 4th ed. Meyer, Joseph E. 304 pages, illustrated (part colored), indexed. Indiana Botanic Gardens, Hammond, Ind. 1960. $3.00

The first edition of *The Herbalist* appeared in 1918—a pocket-sized affair, chuck full of assorted herb lore. This greatly revised and enlarged edition is still a delightful miscellany of herbal uses. To be read and consumed with discretion.

HERBS AND THE EARTH. Beston, Henry. 117 pages, illustrated, indexed. (Dolphin Books) Doubleday and Co., Garden City, N. Y. 1961. 95 cents.

A reappearance in paperback of a much-loved little book which has been too long out-of-print. The author, a master gardener as well as a philosopher and poet, writes of his beloved herbs with great charm.

HOW TO GROW VEGETABLES AND FRUITS BY THE ORGANIC METHOD. Rodale, J. I. and staff of Organic Gardening and Farming Magazine. 926 pages, illustrated, indexed. Rodale Books, Emmaus, Pa. 1961. reg. ed. $7.95: deluxe ed. $12.50

Contains a vast quantity of information on the growing (the organic way) of vegetables, herbs, fruits, and nuts, including tropical and subtropical kinds. Directions given for cooking, freezing, storing. Vitamin contents noted.

THE MEDICINES OF NATURE; THE THOMSONIAN SYSTEM. Clymer, R. Swinburne. 205 pages, indexed. Distributed by Philosophical Publishing Co., Quakertown, Pa. 1960. $4.00

A new edition of a work originally published in 1905 and revised in 1926. The present edition "issued by popular demand with no profit to the Author." Reasons for renewed interest in once discarded common remedies are stated at some length in the Prologue.

THE SIMMONITE-CULPEPER HERBAL REMEDIES. Simmonite, William Joseph and Culpeper, Nicholas. 123 pages, colored front., indexed. Sterling Publishing Co., New York. 1961. $2.95

A selection of the herbal remedies of the seventeenth century astrological physician Nicholas Culpeper and of the twentieth century professor of medicine Dr. W. J. Simmonite. A prefatory note reads: "Reference in the text to the planetary rulers of the herbs will be of interest to those readers who are acquainted with the science of Astrology. Other readers need not observe them."

VEGETABLE GARDENING. Editorial staffs of Sunset Books and Sunset Magazine. 72 pages, illustrated, indexed. Lane Book Co., Menlo, Cal. 1961. $1.50

Clear directions for growing vegetables and herbs in all climates based on U S D A weather records of average hard-frost dates. Planting procedures are well illustrated with pictures and diagrams. Useful space-saving ideas include tub and box gardens. Tempting suggestions for cooking, seasoning, and serving.

HOUSE PLANTS AND GREENHOUSE CULTURE

GREENHOUSE GARDENING AS A HOBBY. Crockett, James Underwood. 288 pages, illustrated (part colored), bibliography, indexed. Doubleday and Co., Garden City, N. Y. 1961. $4.95

Written by an enthusiastic greenhouse hobbyist with a good technical background. Directed towards the needs of the amateur with advice on "do-it-yourself" construction, air conditioning, and heating. Helpful calendar of sowing, planting, and flowering dates.

MODERN INDOOR GARDENING INCLUDING WINDOW BOXES. Gardiner, G. F. 150 pages, illustrated, indexed. St. Martin's Press, New York, 1961. $4.50

Mr. Gardiner, formerly curator of the botanic gardens in the University of Bristol, England, has written primarily for British gardeners, using British terms and proprietary names. For us there are far more useful American publications on house plants.

ORCHIDS; THEIR BOTANY AND CULTURE. Hawkes, Alex D. 297 pages, illustrated (colored front.), indexed. Harper and Brothers, New York. 1961. $6.95

Beginner and veteran orchid grower should find helpful material here. There are chapters on the morphology, physiology, and classification of orchids; on the mechanical operations in cross-pollination; on growing orchids from seed and the care of seedlings. Cultural instructions are given for specific groups; eighty-seven of the genera described are illustrated by photographs or line drawings.

PALMS. Muirhead, Desmond. 140 pages, illustrated, bibliography. Dale Stuart King, Globe, Arizona, 1961. paper ed. $1.95: cloth ed. $3.20

A popular, liberally illustrated treatment of palms and a few palm-like plants with descriptive, cultural, and design notes, by a landscape architect and city planner. Specifically directed to residents of warm or sub-tropical areas.

GENERAL GARDENING

ATOMIC GARDENING. Howorth, Muriel. 75 pages, illustrated, indexed. Distributed by Rogers Book Service, New York. 1960. $3.50

Sponsored by the Atomic Gardening Society, Eastbourne, London, this is the first book on atomic gardening for the layman. Directions are given for managing an atomic-energized experimental garden accompanied by a control garden.

CAREFREE GARDENING; NEW AND EASIER WAYS TO HAVE AN ABUNDANCE OF FLOWERS AND VEGETABLES. Hersey, Jean. 191 pages, illustrated, indexed. D. Van Nostrand Co., Princeton, N. J. 1961. $4.95

According to Mrs. Hersey, there are many kinds of plants that require a minimum of care, and there are numerous short cuts and techniques in gardening and garden design. With a sprightly, informative text she offers freedom to the "garden slave."

THE COMPLETE BOOK OF COMPOSTING. Rodale, J. I., and staff of Organic Gardening and Farming Magazine. 1007 pages, illustrated, indexed, bibliography. Rodale Books, Emmaus, Pa. 1960. $6.95: deluxe ed. $11.00

The fundamental principles of organic gardening are based on composting. In this voluminous work are chapters on history, equipment, numerous methods used in this country and abroad, and the benefits from this type of gardening.

ENCYCLOPEDIA OF GARDENING. Whitehead, Stanley B. Rev. from Walter P. Wright. 787 pages, illustrated. C. T. Branford Co., Newton Centre, Mass. 1960. $5.00

The present compact and comprehensive volume is a thoroughly revised edition of Walter P. Wright's *Everyman's Encyclopedia of Gardening*, written for the English gardener over a quarter of a century ago. Because great differences exist between horticultural techniques and climatic conditions in North America and Great Britain, this text will have small value here.

GARDENING THE EASY WAY; THE HOMEOWNER'S COMPLETE GUIDE TO GARDENING. Steffek, Edwin F. 198 pages, illustrated indexed, bibliography. Holt, Rinehart and Winston, New York, N. Y. 1961. $3.95

The title is deceiving. Is gardening ever "easy?" The Horticultural Editor of *Popular Gardening* has assembled for the inexperienced gardener considerable information on many types of gardening, with good lists for exacting conditions of city, seashore, and mountain.

GARDENING WITHOUT WORK FOR THE AGING, THE BUSY AND THE INDOLENT. Stout, Ruth. 214 pages, illustrated, indexed. Devin-Adair Co., New York. 1961. $3.95

The "unsinkable" Ruth Stout, organic gardener, par excellence, not satisfied to rest on the laurels already won by her *How to Have a Green Thumb Without An Aching Back* (1955) has further developed her famous mulching treatment with "no plowing, no hoeing, no cultivating, no weeding, no watering, no spraying."

A JOY OF GARDENING. Sackville-West, V. 199 pages, indexed. (Dolphin Books) Doubleday and Co., Garden City, N. Y. 1961. 95 cents.

Paper cover edition of title published in 1958.

The original material appeared in England in the books *In Your Garden Again* and *More for Your Garden*. Delightful writing edited for American gardeners by Hermine I. Popper.

LANDSCAPE AND URBAN PLANNING AND GARDEN STRUCTURES

CAPITAL REQUIREMENTS FOR URBAN DEVELOPMENT AND RENEWAL. Dyckman, John W. and Isaacs, Reginald R. 334 pages, indexed. McGraw-Hill Book Co., New York. 1961. $13.50

A thorough analysis of the economics of urban development and renewal by two outstanding authorities in the field of city and regional planning. Detailed cost estimates provide invaluable information. This is an important contribution on this subject.

HOW TO BUILD FENCES AND GATES; revised and enlarged ed. 112 pages, illustrated. (A Sunset Book) Lane Book Co., Menlo Park, Cal. 1960. $1.75

A practical "do-it-yourself" manual, generously illustrated with photographs, plans, and diagrams.

LANDSCAPE ARCHITECTURE; THE SHAPING OF MAN'S NATURAL ENVIRONMENT. Simonds, John Ormsbee. 244 pages, illustrated, indexed. F. W. Dodge Corporation, New York. 1961. $12.75

The author, an eminent landscape architect, is currently teaching landscape design and urban and regional planning at Carnegie Institute of Technology. In this profusely illustrated quarto, he stresses the importance of forms, forces, and features of natural and man-made landscapes in his discussion of the basic fundamental principles of landscape design.

SUNSET PATIO BOOK; revised ed. Editorial staffs of Sunset Books and Sunset Magazine. 166 pages, illustrated. Lane Book Co., Menlo Park, Cal. 1961. $2.00

Although slanted to the needs of Pacific Coast residents, this new edition, with well-written text and exceptionally fine photographs, will inspire gardeners in other areas.

ART, FLOWER ARRANGEMENTS, AND HOLIDAYS

ARRANGING FLOWERS FOR THE SANCTUARY. Patterson-Knight, Francis and St. Claire, Margaret McReynolds. 126 pages, illustrated, indexed, bibliography. Harper and Brothers, New York. 1961. $3.50

Both authors, accredited flower show judges, have had years of experience in church flower arrangements. So many angles have been considered, such as symbolism, subdued light, expense, Bible gardens, church calendars, and containers. A valuable contribution.

ART PRINCIPLES OF FLOWER ARRANGEMENT. Wilson, Clarice T. 111 pages, illustrated (part colored). National Council Books, Philadelphia, Pa. 1961. $5.00

A former officer of the Garden Club of South Carolina and a nationally accredited judge writes of the importance of the principles that go to make up good design as applied to flower arrangements. She devotes separate chapters to form, line, color, texture, selectivity, scale, dominance, rhythm, contrast, proportion, and balance. She touches briefly on judging and period and modern arrangements.

COLOR HARMONIES WITH DRIED FLOWERS. Capen, Barbara M. and McChesney, Marie Louise. 22 pages, illustrated. Floral Fancies, Box 605, Bellport, N. Y. 1960. $1.50

Selection and techniques of drying are well covered in this little booklet by two Long Island women, who run a commercial flower shop that specializes in dried arrangements and unusual containers.

THE COMPLETE BOOK OF WEDDING FLOWERS AND DECORATIONS WITH A SECTION ON ETIQUETTE. Clark, Virginia. 160 pages, illustrated (part colored), indexed. Hearthside Press, New York. 1961. $5.95

Readers of the *Florists' Review* are acquainted with the helpful articles of Mrs. Clark who owns (with her son) a successful flower shop in Iowa. She previously wrote a florists' instruction trade book entitled *Servicing Weddings*. This new offering has a wealth of material including directions for making corsages, bouquets and boutonnieres, and floral decorations for home, hotel, church, and garden weddings.

FLORAL ART FOR PLEASURE. Bunbury, Alice. 20 pages, 55 plates (part colored). Charles T. Branford Co., Newton Centre, Mass. 1961. $5.00

Mrs. Bunbury writes of her own arrangements of flowers that she has grown in her garden in Australia.

FLOWER ARRANGEMENT IN COLOR. Stevenson, Violet. 71 pages, colored illustrations. (A Studio Book) Viking Press, New York. $2.98

From England comes this title written by a flower arranger and author extremely popular in her own country and abroad.

CONSERVATION, NATIONAL PARKS, SCIENCE PROJECTS, ETC.

CAREERS AND OPPORTUNITIES IN SCIENCE; A SURVEY OF ALL FIELDS; new revised ed. Pollack, Philip. 194 pages, illustrated, indexed, bibliography. E. P. Dutton and Co., New York. 1960. $3.95

First edition published in 1945 under the title *Careers in Science*. Useful information on current salaries, lists of colleges and universities, courses available in the Armed Forces. Opportunities for women also evaluated.

FOOD FOR AMERICA'S FUTURE; TWELVE OUTSTANDING AUTHORITIES DISCUSS THE COUNTRY'S ABILITY TO FEED ITS MULTIPLYING MILLIONS. Ethyl Corporation. 167 pages, illustrated. McGraw-Hill Book Co., New York. 1960. $3.95

Excellent brief chapters by eminent men in the fields of soil science, food economics, agricultural research, genetics, physics, and chemistry. "Will America be able to feed its 245 million people in 1975?" The answer from these contributors is an unanimous "yes".

FERNS

THE FERN GUIDE; NORTHEASTERN AND MIDLAND UNITED STATES AND ADJACENT CANADA. Wherry, Edgar T. 318 pages, illustrated, indexed, bibliography, (Doubleday Nature Guides Series) Doubleday and Co., Garden City, N. Y. 1961. $3.95

Over twenty years ago Dr. Wherry published *A Guide to Eastern Ferns*, which was revised in 1942. The present volume covers a much larger region than the previously published work, with descriptions and plates of 135 species of ferns and fern allies. Features, range, habitat and culture in the garden are noted. An analytical key and glossary of technical terms are helpful adjuncts. A comprehensive, authoritative, pocket-size manual.

HOW TO KNOW THE FERNS; A GUIDE TO THE NAMES, HAUNTS, AND HABITS OF OUR COMMON FERNS; 2nd ed. Parsons, Frances Theodora. 215 pages, illustrated, indexed. Dover Publications, New York. 1961. $1.25

To the Dover Publications thanks are due for giving to us again another old-time favorite, first published in 1899 and long out-of-print. Many of us learned our ferns from Mrs. Parsons, and although nomenclature has changed during the past fifty years her informal observations are still very useful for the beginner.

ECOLOGY

HEATHLAND ECOLOGY. Friedlander, C. P. 94 pages, illustrated, bibliography, indexed. Harvard University Press, Cambridge, Mass. 1961. $1.75

The heaths of southern England have been the outdoor classroom of this teacher, who has written of the flora and fauna and geology from practical observations in the field.

MAN IN NATURE. Bates, Marston. 116 pages, illustrated, bibliography, indexed. (Foundations of Modern Biology Series) Prentice-Hall, Englewood Cliffs, N. J. 1961. paper bound, $1.50; cloth, $2.95

A brief history of man's changing relations with nature by a well-known authority, who is endowed with the ability to write lucidly on the many phases of science that have affected man through the ages.

WESTERN FOREST INDUSTRY; AN ECONOMIC OUTLOOK. Guthrie, John A. and Armstrong, George R. 324 pages, maps, illustrated, indexed, bibliography. Johns Hopkins Press, Baltimore, Md. 1961. $6.50

Published for Resources for the Future, Inc. Up-to-date data on the forests and forest industries of the Pacific Slope. Statistical tables through 1959 of lumber production and consumption. Recommendations for sustained-yield operation.

INSECTS

COMMUNICATION AMONG SOCIAL BEES. Lindauer, Martin. 143 pages, illustrated, bibliography, indexed. (Harvard Books in Biology no. 2) Harvard University Press, Cambridge, Mass. 1961. $4.75

According to the experimental results of Dr. Lindauer and of his former teacher and present

colleague, Professor Karl von Frisch, bees have a "language" by which they communicate with one another. There are chemical, optical, and mechanical signals. An entertaining subject presented in a popular style.

INSECT LIFE AND INSECT NATURAL HISTORY; 2nd ed. Frost, S. W. 526 pages, illustrated, indexed, bibliography. Dover Publications, New York. 1959. $2.25

This new edition, first published in 1959, is a revised version of the work formerly entitled *General Entomology*. A textbook for elementary college entomology. The author is Professor Emeritus of The Pennsylvania State University.

THE INSECT WORLD OF J. HENRI FABRE. Teale, Edwin Way, ed. 333 pages, indexed. Apollo Editions, New York, N. Y. 1961. $1.95

In the foreword of the 1949 edition Mr. Teale stated that in his editing he had followed the original translation of Alexandra Teixeira de Mattos. Not unlike Fabre in many ways, Mr. Teale has long studied insects and has a warm appreciation of this famous French writer and entomologist, of whom he writes in the biographical introduction.

REGIONAL BOOKS

THE FORGOTTEN PENINSULA; A NATURALIST IN BAJA CALIFORNIA. Krutch, Joseph Wood. 277 pages, illustrated, (colored front.) William Sloane Associates, New York. 1961. $5.00

Another gem from the pen of one of America's finest writer-naturalists, who loves our desert regions—their plants, animals, historic backgrounds, and people. Mr. Krutch has the supreme gift of conveying to his readers vivid glimpses of these lands of wonder.

GARDENING IN BRITAIN. Hadfield, Miles. 483 pages, illustrated, bibliography, indexed. C. T. Branford Co., Newton Centre, Mass. 1960. $12.00

Fascinating history of British gardens from the time of the Roman occupation until World War II, with an amazing wealth of biographical accounts of British plantsmen and landscape gardeners. Contains a comprehensive bibliography.

GARDENS OF ROME. Faure, Gabriel. 201 pages, illustrated. (Beau Pays Series) Distributed by Oxford University Press, New York. 1960. $8.50

In 1923, Monsieur Faure wrote on the gardens of Rome in a quarto limited edition which soon went out-of-print. Since then he has stayed in Rome many times and visited more gardens. This new volume, translated by George Millard, is illustrated with fine photographs and offers the visitor to the Eternal City many glimpses and descriptions of the well-known and less-known gardens.

ILLINOIS WILD FLOWERS. Voss, John and Eifert, Virginia S. 256 pages, illustrated, bibliography, indexed. (Popular Science Series vol. III) Illinois State Museum, Springfield, Ill. 1960. $2.25

Over two-hundred black and white photographs with descriptive text that abounds in interesting facts concerning uses and plant lore. Arranged according to season.

NEW RECORDS FOR ILLINOIS VASCULAR PLANTS. Winterringer, Glen S. and Evers, Robert A. 135 pages, maps, bibliography, indexed. (Scientific Papers Series, vol. XI) Illinois State Museum, Springfield, Ill. 1960. $3.25

Additional information obtained since the publication in 1955 of *Vascular Plants of Illinois* by Jones and Fuller.

THE OUTERMOST HOUSE; A YEAR OF LIFE ON THE GREAT BEACH OF CAPE COD. Beston, Henry. 222 pages. (Explorer Books Edition) Viking Press, New York. 1961. $1.25

A welcome paperback edition of a delightful nature-writing classic.

STATE PARKS OF CALIFORNIA. Robinson, John and Calais, Alfred. 94 pages, illustrated, indexed. (A Sunset Book) Lane Book Co., Menlo Park, Cal. 1961. $1.95

Well-illustrated guide to one hundred and seventy California State Parks and thirty-seven Historic Monuments, giving location of campsites, picnic units, swimming and fishing facilities, elevations, acreage, and facts of current and historical interest.

SUNSET WESTERN GARDEN BOOK; rev. ed. Editorial staffs of **Sunset Books** and **Sunset Magazine**. 384 pages, illustrated, indexed. Lane Book Co., Menlo Park, Cal. 1961. spiral binding, $3.95; gift binding, $4.95

Revised and enlarged edition with updated material on insecticides and herbicides. Aims to cover garden climates in seven western states and Hawaii.

BIOGRAPHY AND JOURNALS

AUDUBON AND HIS JOURNALS. Audubon, Maria R. With zoological and other notes by Elliott Coues. 2 vols. 532, 566 pages, illustrated, indexed. Dover Publications, New York. 1960. Each vol. $2.00; set $4.00

A complete, unabridged reprinting of an out-of-print collector's item, originally published in 1897, with critical notes by Elliott Coues and a sympathetic biography by Audubon's granddaughter.

MARK CATESBY; THE COLONIAL AUDUBON. Frick, George Frederick and Stearns, Raymond Phineas. 137 pages, illustrated, indexed, bibliography. University of Illinois Press, Urbana, Ill. 1961. $5.00

The New York Botanical Garden is the proud owner of Catesby's two-volume *Natural History of Carolina, Florida and the Bahama Islands:* Containing the Figures of Birds, Beasts, Fishes, Serpents, Insects and Plants . . . with Descriptions in English and French, published 1741-1743. The authors of this present biography have done a scholarly and very readable work. The text is documented with references to the source material from which they have drawn. Not only concerned with the life of Catesby and his contributions, but with the lives of many naturalists of the early eighteenth century here and abroad whom Catesby knew.

THE HEART OF THOREAU'S JOURNALS; 2nd rev. ed. Shepard, Odell, ed. 228 pages, indexed. Dover Publications, New York. 1961. $1.45

Mr. Shepard's selections of some of the journals written from 1837 to 1861 have been

(Continued on page 152)

Reviews of Recent Botanical Books

MODERN BIOLOGY. Moon, Truman J., James H. Otto, Albert Towle. 758 pages, illustrated, indexed. Holt, Rinehart & Wilson, Inc., New York. $5.60

The present book is the latest revision of a text that has seen wide use for over thirty years. A successful high school biology text must deal with so many topics in order to satisfy the requirements of various and varied state syllabi, that no topic can be treated exhaustively. Though the authors cannot be expected to stress recent additions to our biological knowledge before these topics are included in subject matter ordinarily taught, the value of the book would have been increased by further information on such topics as DNA, antibodies, etc.

The illustrations are excellent and attractive. Particular reference should be made to the transparencies of the frog and of man. This revision retains the good features of previous editions, i.e., clear and concise definitions, properly organized topics, and material for enrichment of basic concepts. LEON HERVEY

FLORA OF THE SANTA CRUZ MOUNTAINS OF CALIFORNIA. A MANUAL OF THE VASCULAR PLANTS. Thomas, John Hunter. 434 pages, illustrated, indexed. Stanford University Press, Stanford, California. 1961. $8.50

Many years of field work by the author and his predecessors have resulted in this extremely useful manual of the flora of a well-defined area that forms a distinct geographical and phytogeographical unit and that is heavily populated. The Santa Cruz Mountains are part of the Coast Range of California, extending from San Francisco southward to the Pajaro River, somewhat north of the Monterey Peninsula.

W. C. STEERE

GRASSES OF BURMA, CEYLON, INDIA, AND PAKISTAN. Bor, N. L. 767 pages, illustrated, indexed. Pergamon Press Inc., New York. 1960. $25.00

A detailed taxonomic treatment, arranged according to a new general system of the grass family which takes account of recent morphological studies and evolutionary concepts.

ARTHUR CRONQUIST

THE PRE-CAMBRIAN GEOLOGY AND GEOCHRONOLOGY OF MINNESOTA. Goldich, Samuel S., Alfred O. Nier, Halfdan Baadsgaard, John H. Hoffman, and Harold W. Krueger. 193 pages, illustrated, indexed. University of Minnesota Press, Minneapolis, Minn. 1961. $4.00

Age determination of rocks and their relative stratigraphic sequences by radio-activity, particularly in the Pre-Cambrian intrusives and meta-

(Continued on page 152)

MEMBERSHIP

We were delighted to welcome the following new members between January 1, 1961, and March 31, 1961.

NEW MEMBERS

Supporting

Mrs. F. Higginson Cabot
Howard W. Maxwell, Jr.
Mrs. Dudley Wadsworth*

Contributing

Mrs. Robert Fliess*
Mrs. Walter P. Gage
Mrs. Herman M. Kurtz*
Mrs. Ethelbert Ide Low*
Mrs. Hermann G. Place*

Husband and Wife

Dr. & Mrs. Irving Abrahams
Mr. & Mrs. John C. Bruckman
Dr. & Mrs. William C. Clyne
Dr. & Mrs. Ralph M. Crowley
Mr. & Mrs. John Dougherty
Mr. & Mrs. Timothy A. Gerne
Mr. & Mrs. Matthew Kabriski
Mr. & Mrs. Karl Keller
Mr. & Mrs. Charles A. Loreto
Mr. & Mrs. Earl G. Lundstrom
Mr. & Mrs. Aaron S. Naimark
Mr. & Mrs. Charles O'Brien
Mr. & Mrs. Robert G. Shanklin
Mr. & Mrs. Philip Sipser
Mr. & Mrs. George B. Stanton
Mr. & Mrs. Richard G. Unger
Mr. & Mrs. Charles Vogel

Annual

Richard Abbott
Mrs. Thomas M. Alexander
Miss Adele Anderle
Leo J. Armatys
Mrs. Boudinot P. Atterbury
Miss Betty Barford
Mrs. William H. Batchelor
Miss Dorothy S. Bradford
Mrs. G. E. Brewer, Jr.
Charles W. Busk
Mrs. Douglas Calkins
Mrs. Edward C. Chorley
Nicholas P. Cirigliano
Mrs. H. M. Clawson
Mrs. Carleton M. Cornell
Miss Grace K. Eiselstein
Ernest Faris
Mrs. Kenneth G. Futter
Mrs. A. Sumner Gambee
Bernard Glinski
Mrs. Margaret Grace
Mrs. Robert Nathan Graham
Miss Margaret Haegel
Dr. Charles W. Hayden
Miss Beatrice Hawkins
Mrs. Hamilton Hicks, Jr.
Mrs. Ralph Holmes
Ralph Jarcho
William Keith, Jr.
Mrs. Harvey M. Kelsey, Jr.
Marvin S. Kotzen
William W. Krantz
Mrs. Harriet Kushner
Miss Sydney S. Lane
Mrs. Robert C. Laurence, Jr.
Mrs. Bernhard Leirmoe
Mrs. Dunbar Lockwood
Capt. T. Leopold McC. Lonsdale
Mrs. Richard Lowy
Patrick Lundy
Eric W. Lynn
Mrs. A. S. Martin
Richard C. Mugler
Don Muller
Miss Lucy Mueller
Gustav Meyburg
Mrs. Audrey H. O'Connor
Mrs. R. G. Olmstead
Mrs. Walter R. Peabody
Miss Genevieve B. Perri
Mortimer D. Phillips
Miss Susan Scott Phillips
Mrs. Mahlon Pitney
Miss Dorothy Lucille Ransom
Mrs. Ruth Reisch
Mrs. Fortune Roberts
Mrs. S. Harrison Rollinson, Jr.
Mrs. Eve B. Root
Brig. Derek Schreiber
Dr. E. Seale
Mrs. Constance W. Smith
Miss Kathleen M. M. Smith
Mrs. Thomas S. Shinn
Mrs. James Talcott
David E. Thomas
Mrs. Ernest B. Tracy
Mrs. A. D. Turcas Throckmorton
Miss Edith W. Vail
Mrs. Marshall Waterman
Miss Amelia H. Weber
Mrs. Samuel J. Wendt
William Mason Wetzel
Mrs. Gustave E. Wiedenmayer
Mrs. Warner M. Willcox
Miss Trixie Wolf
Allan G. Wood

*Change in Membership Classification

NEWS, NOTES and COMMENTS

At its annual meeting on May 15, 1961, The New York Botanical Garden presented Distinguished Service Awards to Mrs. Ethel Anson S. Peckham, Norman Taylor, and Henry Teuscher. Excerpts of the citations follow:

From her early childhood Ethel Anson S. Peckham was interested in plants, and particularly in garden plants. Her connection with The New York Botanical Garden began in 1915, in which year she exhibited a collection of narcissus in a flower show at the Garden. For a number of years thereafter she served as a member of the Garden Advisory Council.

With her cooperation specimens of iris were secured from many places throughout the United States. The original planting was augmented by further contributions and in 1920 was established as the first test garden of the American Iris Society. Mrs. Peckham actually did much of the planting with her own hands.

Through her interest and that of the Dutch Bulb Growers Association, the Garden received from Holland a gift of thirty-seven thousand bulbs of narcissus to be used as "the foundation of a semi-natural planting of permanent interest." In addition, Mrs. Peckham purchased ten thousand bulbs for naturalizing and for a special display section, from a Narcissus Fund that had been raised under her direction. She not only selected the bulbs and planned their arrangement, but also personally supervised the planting, in October 1924.

In 1925 Mrs. Peckham contributed an interesting and valuable collection of bulbous plants to the Garden. In the following year she supervised the replanting of the test garden of the American Iris Society when "four new beds were made for Dr. John K. Small's collection of native iris to test for hardiness in this climate."

Mrs. Peckham found time to lecture on iris, narcissus, and other plants in the Free Saturday Afternoon Lecture Programs. She wrote articles on iris and daffodils for the *Journal of The New York Botanical Garden* and the *Bulletin of the American Iris Society,* and prepared six articles for *Addisonia* on narcissus. She made a study of dwarf iris, in which over one thousand varieties were alphabetically arranged, and edited the three-hundred-page Alphabetical Check List published in 1929, on which earlier work had been done by John Caspar Wister and Robert Sturtevant.

Mrs. Peckham organized the New Rochelle Garden Club and served several terms as its president. She also functioned as a director for the Ninth District of the Federated Garden Clubs of New York State and a director of the American Iris Society.

To Mrs. Peckham, enthusiastic horticulturist, author, and lecturer, and Honorary Curator of the iris and narcissus collections at the Garden since June 16, 1927, The New York Botanical Garden presents its Distinguished Service Award.

In 1904 Norman Taylor became Museum Aide in The New York Botanical Garden, and during the next seven years filled various positions of increasing responsibility in the Garden. His formal duties were interspersed with numerous travels in the Caribbean. Later he was Curator of the Brooklyn Botanic Garden. During these years he became interested in the native flora of the New York region and published a number of notes on it, and a memoir in 1915. This involved an interest in ecology, the production of several papers on that subject, and editorship for the Ecological Society of America. While his devotion to botany never dwindled, Dr. Taylor now broadened his attack to include horticulture. In 1936 he edited the *Garden Dictionary,* which in subsequent editions became the *Garden Encyclopedia;* the fourth edition appeared in 1961. He was editor of botany, horticulture, and forestry for the Merriam-Webster dictionaries, and produced a series of books on gardening. At the same time he was concerned with the quinine industry, acting as director of the Cinchona Products Institute and as adviser to the Cinchona Institut of Amsterdam, and traveling extensively in Mexico, Brazil, Bolivia, Ecuador, and Peru. A popular book on drugs bears witness to this facet of a many-sided intellectual life.

This varied and productive career was signalized in 1936 by the award of the Gold Medal of the Massachusetts Horticultural Society, and in 1958 by the honorary degree of Doctor of Science conferred by Washington University in Maryland.

The New York Botanical Garden is honored to have in some part shared in Dr. Taylor's many scholarly activities, and in recognition of his many distinguished contributions to botany and horticulture now presents him with its Distinguished Service Award.

Henry Teuscher, a distinguished member of the horticultural fraternity and a citizen of Canada, was born in Germany, where he secured the equivalent of a Master's degree in landscape architecture and horticulture. He acquired further experience, practical knowledge, and skills by acting as an assistant at the botanical garden in Dahlem-Berlin. In 1920 he came to the United States, accepted the position of botanist in charge of the Morton Arboretum in Lisle, Illinois, and served there until 1929 when he was appointed Director of the Boyce Thompson Arboretum in Yonkers. In 1932 he entered the service of The New York Botanical Garden with the title of Dendrologist and in 1935 left that post to accept an appointment as Superintendent and Chief Horticulturist at the then newly established botanical garden in Montreal, in which institution he has served with distinction, his present title being that of Curator.

While Mr. Teuscher is thoroughly familiar with all phases of horticulture, he is probably best known for his knowledge of trees and shrubs. He has written extensively on the subject of hardiness in plants, and in 1956 published a volume entitled *Window Box Gardening*, which was the first complete manual on outdoor window box gardening . . Another publication is *The Soil and its Fertility*, of which he was the author jointly with R. Adler.

He has written many articles for *The Journal of The New York Botanical* and also descriptions of plants for *Addisonia*.

In 1948 Mr. Teuscher identified the two hundred specimens in the Garden's collection of conifers, a gift of Col. Robert H. Montgomery, and described a new ornamental dwarf form of Colorado spruce.

The reports of the President, Charles B. Harding, of the Director, Dr. William C. Steere, of the Advisory Council and the Volunteer Associates are not included in these pages, since they will be mailed to members of the Garden.

The report on the fund for the library wing, which was presented by Mrs. Hermann G. Place, a Vice President of The New York Botanical Garden, follows:

At last the funds necessary to build our new library wing are in hand. Our target was $500,000 which we raised, and because of the interest and support of Newbold Morris and the Park Department, the City of New York has included the most needed matching funds of $500,000 in this year's capital budget. However, I am going to tell you something that has made all of us very happy. We did actually raise $655,019.81 instead of $500,000. It just seemed to roll in.

The service contract has been sent by the Park Department to the Board of Estimate and we hope, within a few weeks, that the Board of Estimate will approve this contract so that our architects, Eggers and Higgens, may complete the working drawings and that the plans will be out for bids. There is no target date for the ground-breaking, as we have come to realize that all procedures must follow a definite pattern and cannot be accelerated in any way. At least, these methods are conducive to character building best expressed by patience and restraint. However, I do predict that within the next few months we should be able to start.

It is with the feeling of joy and gratitude that I am privileged to announce that the Board of Managers of The New York Botanical Garden has unanimously voted to name the new library wing the Harriet Barnes Pratt Library in recognition of Mrs. Pratt's years of devotion to the Garden and her great gifts, not only of a financial nature, but gifts of the spirit too. Her constant help and love of the Garden have been beacons to light the way.

I want to thank the Board of Managers, the staff of the Garden, and especially Mr. Harding and Dr. Steere without whose help and support our new library wing could never have come to pass. Thank all of you for what you have done to bring this about.

The members, assembled in annual meeting, adopted Mrs. Pratt's suggestion that the reading room in the new library wing be named the Angela Moore Place Reading Room, in appreciation of Mrs. Place's tireless efforts in the raising of the funds.

Re-elected to the Board of Managers (Class of 1964): W. Earle Andrews, Sherman Baldwin, Henry F. du Pont, William E. Hutton, Rev. Laurence J. McGinley, S. J., Mrs. Harold I. Pratt, Mrs. David Rockefeller, Dr. William C. Steere, and Joseph R. Swan.

Elected to the Corporation of The New York Botanical Garden: Mrs. Franklin B. Benkard, Mrs. F. Higginson Cabot, Mrs. Edward W. Freeman, Mrs. Ricardo Gonzales, Mrs. Donald Lowe, Mrs. Harold E. Anthony, and Harold Epstein.

SPRING GARDEN TOUR, 1961

(Based on the notes written by Howard W. Swift, Assistant Curator of Education)

Its illustrious history, its advantageous location, its natural beauty, and its productive soil have made Bucks County, Pennsylvania, one of the famous regions in the United States. Of the well-proportioned mansions and farmhouses, many are over two hundred years old and most frequently built of native stone. Artists, authors, playwrights, and sculptors, drawn by the county's beauty and accessibility, have chosen to live in New Hope and environs. In more recent years industry has moved into the area—the Fairless Works of United States Steel is one of the largest plants.

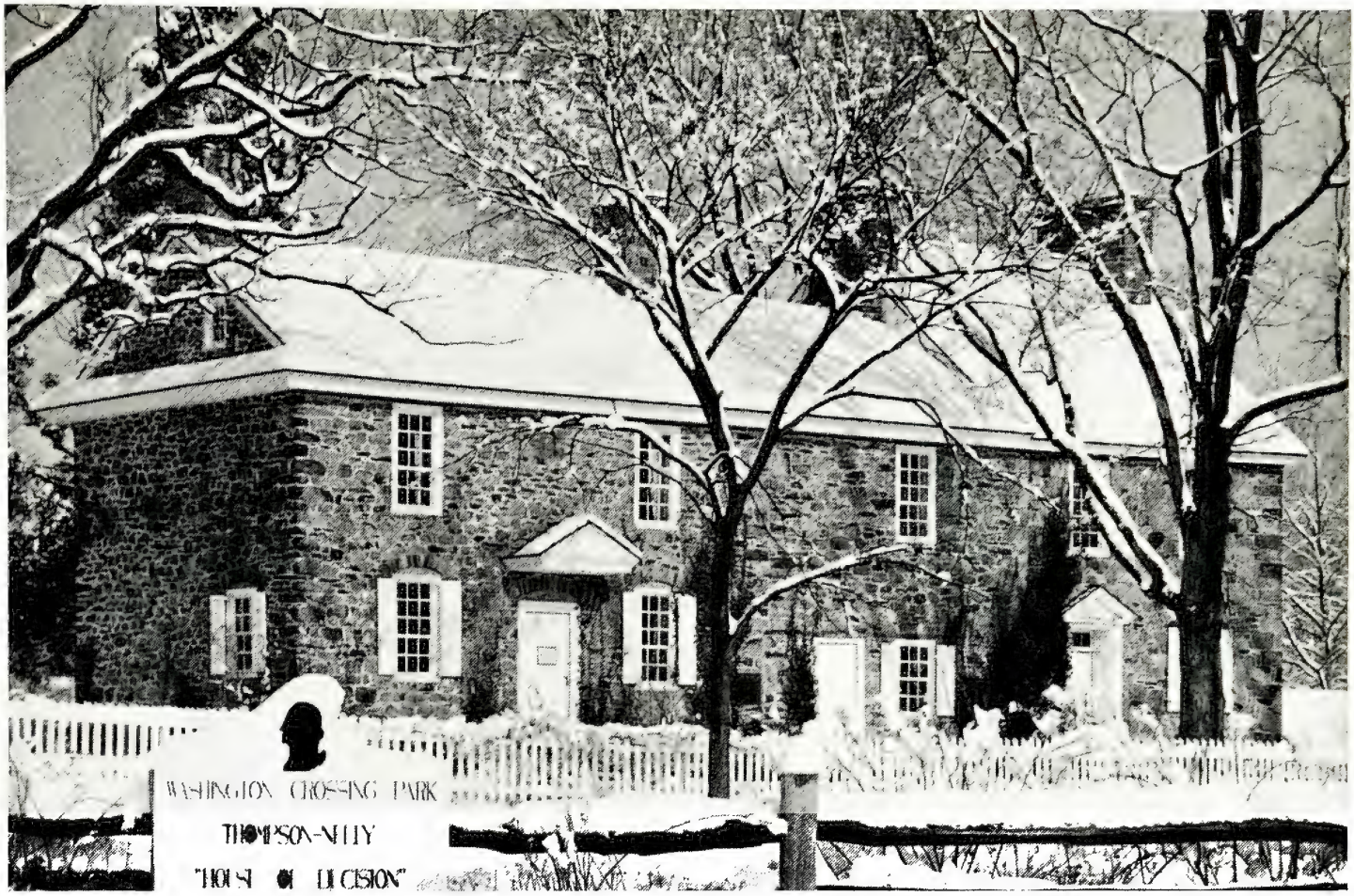
On the day's tour stops were made at the Washington Crossing Memorial Building, the Washington Crossing Methodist Church, where coffee was served, and at the Thompson-Neely "House of Decision." This has been authentically restored and furnished. The accompanying illustration shows this charming Colonial house in the midst of winter. On the day of the tour the lilacs, some of which are more than one hundred and fifty years old, were bearing their fragrant blooms. A red-cedar *(Juniperus virginiana)* near the path to the root-cellar was noted as being twenty-seven years old when Washington was born. Nearby stands one of the largest hackberry trees *(Celtis occidentalis)* in the area.

Visits were made to several homes and gardens: to Lenteboden, which Charles H. Mueller maintains as a commercial venture; to Gaystone, the home and lovely gardens of Mr. and Mrs. Franklin T. McClintock; to Beaumont House, part of which was erected in 1732 and an addition in 1808 on a William Penn Grants Land. The present owner is Dr. John A. Flood, the Burgess of New Hope. From the native stone house of Mr. and Mrs. Allan Miller, and the expansive lawn around it, there is a panoramic view of the peaceful countryside. Near the entrance to this one-hundred-and-twenty-acre farm are two acres of apple, cherry, and pear trees. On the opposite side of the drive is a garden that has been developed in natural manner, with stream, pools, and outcropping rock. Rhododendrons, azaleas, and laurel furnish background for spring bulbs.

Bowman's Hill State Wildflower Preserve was included on the day's itinerary. Here, on a tract of one hundred acres, set aside by Washington Crossing State Park in 1934, are trees, shrubs, ferns, and flowers native to Pennsylvania. About three hundred species were found to grow naturally on this land, and several hundred more have been introduced. These plants are dedicated as living memorials to the patriots of Washington's Army, who camped on these hills before the battle of Trenton and the crossing of the Delaware on Christmas Night, 1776.

Along the winding entrance to the preserve

Lenteboden—the gardens which Charles H. Mueller maintains as a commercial venture. There are more than one thousand separate plantings of tulips, narcissi, and other bulbs. Many new varieties are imported from Holland and grown on trial in their first American appearance.



The Thompson-Neely "House of Decision" in which General George Washington held conferences to perfect plans for the crossing of the Delaware.

are many fine American beeches *(Fagus grandifolia)* and large patches of May-apple *(Podophyllum peltatum)*. Along the Medicinal Trail yellow ladyslipper *(Cypripedium pubescens)* was blooming, while the pink ladyslipper *(C. acaule)* had not yet opened its buds. The white trillium *(T. grandiflorum)* was blooming freely, and the red trillium *(T. erectum)* was also in flower. The rose-purple flower of the fringed polygala *(P. paucifolia)* caught the attention of visitors. They were also attracted by the kidney-shaped leaves of the twinleaf *(Jeffersonia diphylla)*, by *Hepatica acutifolia* and *americana*, goldenseal *(Hydrastis canadensis)*, the walking-fern *(Camptosorus rhizophyllus)*, and *Sedum ternatum*, the only sedum that grows in moist shady locations.

Wild ginger *(Asarum canadense)*, pipsissewa *(Chimaphila maculata)*, Solomons-seal *(Polygonatum commutatum)*, and the bright fire-pink *(Silene virginica)* drew notice on Harshberger Trail. Over a dozen trails from one hundred to a thousand or more feet long have been laid out through the woods and adjacent fields.

Because of interest in conservation and in the projected Native Plant Garden at The New York Botanical Garden. Bowman's Hill State Wild Flower Preserve had an especial appeal to many on the Spring Garden Tour. This delightful sanctuary should be visited for a longer period than the full schedule on May 10, 1961, allowed in order that one may become acquainted with its wealth of native plant material.

The Native Plant Garden of The New York Botanical Garden

As the bulldozer ruthlessly clears the way for housing projects, shopping centers, and throughways, it not only roots out and destroys the native plants in its path—it also creates environmental conditions in a much wider area that are less favorable and even fatal for wild beings in general. Although the inroads of this "American way of life" are accepted as inevitable by too large a majority of people, those of us who are conservation-minded must be deeply concerned over the ever-increasing rate of disappearance of one of our great natural resources, our native wild plants. Every year that passes brings some handsome wildflower closer to extinction, in direct proportion to the increase in population and the resulting growth of urban areas. Fortunately, this growing emergency has been recognized, and steps have been taken to remedy it by forward-looking and philanthropic citizens and by conservation-oriented organizations, as the Nature Conservancy, the Audubon Society, The Garden Club of America, and many others, through the establishment of natural areas for the permanent protection of native plants and animals.

The New York Botanical Garden has concerned itself with the preservation of the native flora, as well as its elucidation through handbooks and manuals, since the turn of the present century. In 1902, Mrs. Elizabeth G. Britton, wife of the first director of the Garden, was one of the prime movers in organizing the Wild Flower Preservation Society of America (succeeded in 1933 by The Wild Flower Preservation Society, Inc.) and became one of its first trustees. Within a few years, as trustee and later as secretary and treasurer—and because of her vigor and strong conviction—Mrs. Britton had become the motivating force of the organization. By her lectures, published papers, and extensive correspondence, she did much to arouse and develop an enlightened public attitude towards conservation. Still timely and of much interest are her fourteen articles on "Wild Plants Needing Protection," with colored plates from original paintings by Mary Eaton, which appeared in *The Journal of The New York Botanical Garden* between 1912 and 1929.

Thanks to the wisdom and foresight, a half-century ago, of pioneers in the field of conservation of native plants, an undisturbed area within The New York Botanical Garden was set aside for a native plant garden, and later fenced. The almost miraculous existence of this protected area, with a variety of habitats in the midst of a densely populated section of New York City, provides an excellent opportunity for the establishment of a Native Plant Garden.

We stress again The New York Botanical Garden's strong and historic interest in the Native Plant Garden as well as its commitment to it today, even though its development has been delayed for lack of funds. In 1901, the Misses

Above. Hepaticas, *Hepatica acutiloba* and *H. americana*, grow happily in Bowman's Hill State Wild Flower Preserve.
Left. The royal-fern, *Osmunda regalis*, uncurls in early spring. These are the kinds of plants that will be seen in the Native Plant Garden of The New York Botanical Garden.

Olivia and Caroline Phelps Stokes of New York presented to The New York Botanical Garden a fund of $3,000, on condition that the interest thereon "should always be used for the investigation and preservation of native plants or for bringing the need of such preservation of native plants before the public." In spite of the prophetic vision and worthy cause of the donors of the Stokes Fund, the income from this fund does not go very far, especially today. The Committee needs much more money—the income from $250,000—to establish and maintain a Native Plant Garden of the outstanding quality both necessary and possible.

Under the leadership of Mrs. John Donaldson, Mrs. Percy Douglas, and other responsible citizens, a Committee on the Native Plant Garden has been formed. It includes members of national garden clubs, conservation groups, scouts, Audubon Society, horticultural and botanical societies (including the American Fern Society and The Wild Flower Preservation Society, Inc.) authors, photographers, lecturers, teachers, and others.

The Committee plans to raise an endowment fund of $250,000, the income from which will guarantee support and maintenance of the Native Plant Garden in perpetuity, and will permit effective programs of teaching and research on native plants, as well as the publication of leaflets and pamphlets to enhance and to reinforce the public interest in conservation of native plants. Through research on propagation of native plants, and on their ecological requirements, tolerance, hardiness, and other important questions, we may yet save some of them from permanent extinction. Moreover, with such information available, nurseries may be encouraged to propagate wild flowers instead of collecting them in their natural habitats, usually illegally.

The Committee plans to donate most of the plants needed, which will be obtained from areas to be bulldozed, cleared, or otherwise made inhospitable to desirable native plants, as well as from their own properties, using accepted conservation practices in so doing. With few exceptions, the native plants will be those indigenous to the northeastern United States, both rare and common. Emphasis will be placed on wild flowers, herbs of interest, and ferns. Space will not permit the introduction of large woody plants, even those with handsome flowers. However, most if not all of them already flourish elsewhere on the grounds of The New York Botanical Garden.

The protected land to be devoted to the Native Plant Garden lies within a fenced area adjacent to the Thompson Memorial Rock Garden, within the grounds of The New York Botanical Garden. Its approximately three acres present a surprising range of habitats, including various types of woodland, rocks, marshy areas, a stream, and a sunny meadow. The plan prepared by Jack Crawford for the Committee covers primarily the wooded area, in which a water system and paths have already been installed, as well as several thousand plants. The Committee plans to develop the meadow area next and eventually to add a limestone section. Coldframes and a propagating house are essentials. A naturalistic shelter is planned; this will serve as an information center, house pamphlets and other educational material, and provide a place to demonstrate present and future plans of the Garden and to show pictures, changed each week, of important plants, flowers, seeds, and birds to be seen at the time.

A native-plant gardener who will put nearly full time into guiding and informing the public half the year, as well as guarding the rarer plants, and will engage in research, teaching, lecturing, and writing the other half, is an essential part of the Committee's plan. At first, planting and adequate labeling will be heavy and time-consuming responsibilities, whereas the research and educational functions will be stressed later. With its manifest dedication to botany and horticulture, The New York Botanical Garden can provide outstanding facilities to the Native Plant Garden, in addition to the land itself. The magnificent Library is an excellent resource, and the staff can furnish help and advice on most botanical and horticultural topics.

In her recent book, *This is the American Earth*, Nancy Newhall gives a thoughtful and moving definition of conservation as "humanity fighting for the future." Please join this fight and help us bring back to New York City native plants that have disappeared completely from this great urban area, and others that are on the verge of extinction, as well as the commoner native plants that everyone should know. The Committee hopes that you will contribute generously to make this Native Plant Garden a reality, and a positive force as well as a living example of conservation in New York City.

The Batsto Nature Area in southern New Jersey's Wharton Tract was opened to the public on May 27, 1961. The planning of the preserve was done largely by James A. Sharkey and William Mullen, botanist and archaeologist, of the Wharton Tract. The project is directed by the New Jersey Department of Conservation and Economic Development.

The New Jersey Federation of Women's Clubs raised the funds for the Batsto Nature Trail, which runs through part of New Jersey's famous pine barrens. Along the trail are more than one hundred different kinds of native plants. Mr. Sharkey will conduct groups of adults through the Batsto Nature Area, and William Chaney, a botanist, has been engaged to guide groups of children through the area this spring and summer. Tours should be booked through the Wharton Tract Office, Greenbrook R. D. 2, Egg Harbor City, New Jersey.

Activities of the Director and Staff. Within the past few months, Dr. William C. Steere, Director, visited the Medical School of Tufts University, also Brandeis University, which has many impressive new buildings; visited Sydney Gould in his newly furnished quarters at the Connecticut Agricultural Experiment Station, where he will carry on his work on the preparation of an international plant index, using punch cards and data processing machines, through a NSF grant to the Garden; visited the University of Colorado, Boulder, as consultant on the expansion program of the Department of Biology; attended a meeting in Washington, D. C., of the Governing Board of the American Institute of Biological Sciences; a meeting in Buffalo, New York, of the Council of the New York State Association of Museums; a meeting of the Board of Trustees of the Bayard Cutting Arboretum at Oakdale, Long Island; a meeting of the New York Center for Biomathematical Research at the Sloan Kettering Institute, New York City; a meeting of the Advisory Council of the Department of Biology of Princeton University at Princeton, New Jersey; a meeting in Blue Mountain Lake, New York, of the Committee on Museum Resources; a meeting in Washington, D. C., of the Advisory Council of the Biological Sciences Communication Project, AIBS; and a luncheon of the Park Association of the City of New York at the Riverdale Yacht Club, New York City.

Dr. Bassett Maguire, Head Curator and Coordinator of Tropical Botany, lectured on "Some Flowering Plants of the South American Tropics" at the fifteenth annual Garden Symposium at Colonial Williamsburg. Dr. Maguire gave this lecture at the May meeting of Torrey Botanical Club, which was held at the Garden.

Dr. Harold William Rickett, Bibliographer and Senior Curator of the Library, was shown the facilities of the Brooklyn Public Library after he and Dr. Steere had lunched and consulted with Dr. Francis St. John, the Director of the Brooklyn Public Library, on the plans for the new wing to the Garden's Library. Dr. Rickett spent several days at the Gray and Arnold Arboretum Herbariums of Harvard University.

Dr. Arthur Cronquist, Curator, gave a seminar at the University of Minnesota. He collected in a sequestered area of the Atomic Energy Commission around Las Vegas, Nevada, with Dr. Janice Beatty, ecologist of the Atomic Energy Commission. Dr. Cronquist has also been collecting in Utah and will remain in that area until the middle of July. He will participate in the Science Institute for high school biology teachers to be held at Washington State University, at Pullman, and will give several seminars in the West.

Dr. Richard M. Klein, Alfred H. Caspary Curator, attended a meeting of the New England Section of the American Society for Plant Physiologists in Durham, New Hampshire, and the annual meeting of the Society for Economic Botany held in the Faculty Club of the Massachusetts Institute of Technology.

Rachel di Noia, who has assisted Dr. Steere during her summer vacations, will begin work for her Master's degree at Fordham University in cooperation with The New York Botanical Garden under Dr. Klein. Biruta Eimanis who assisted Dr. P. P. Pirone, Senior Plant Pathologist, in his laboratory for a year and a half, is working for her Ph.D. at Pennsylvania State University.

Dr. David J. Rogers, Curator of Economic Botany, attended a meeting at the National Institutes of Health, Bethesda, Maryland, at which botanists, biochemists, and pharmacologists considered ways and means by which these three

A bee gathers nectar from the New England Aster, Aster *novae-angliae*, in Bowman's Hill State Wild Flower Preserve.

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groups can cooperate in expanding investigations on drug plants of the world and in collecting information on the fast diminishing native users of natural drugs. Dr. Rogers also attended the annual meeting of the Society for Economic Botany; the topic of the symposium was "Nutrition, Feeding a Hungry World."

Dr. Marjorie Anchel, Senior Research Associate, accompanied by Dr. Nalini N. Valanju and Dr. Trevor C. McMorris, Research Associates, attended the meetings of the Federation Proceedings at Atlantic City, New Jersey.

T. H. Everett, Assistant Director (Horticulture) and Elizabeth Hall, Sarah Gildersleeve Fife Research Librarian, accompanied the Advisory Council when it visited the Edward C. Delafield estate at Riverdale, New York. The Council lunched at the Snuff Mill before visiting Mr. Delafield's estate.

Dr. Clark T. Rogerson, Curator of Cryptogamic Botany, has been concentrating his efforts and energy in getting *Mycologia* back on schedule. It has been a tremendous task, in which Dr. Rogerson has been aided by Mary Fleming, Technical Assistant. The November-December 1959 issue and the January-February 1960 issues have been mailed; the March-April and May-June 1960 issues are at the printers, and the July-August issue is being made ready for the printers.

Mrs. Fleming has been appointed chairman of the rhododendron display of the American Rhododendron Society, New York and New Jersey Chapters, at the International Flower Show in March 1962.

Dr. Caroline Allen, Research Associate, discussed "Taxonomy" at a Senior Seminar of the Department of Plant Science of Vassar College, Poughkeepsie, New York. Dr. Allen gave an illustrated lecture, in the In-Service Course for Teachers at the Garden, on "The Arnold Arboretum and Its Gift to Gardeners." She was associated with the Arboretum for a number of years. Dr. Allen reecntly visited the Gray and Arnold Herbariums of Harvard University.

Dr. Herman Becker, Research Associate, is collecting fossils in Oregon, Utah, and Montana. He will return to the Garden in late August or early September. Peter Roff, a botany student at Hunter College and a member of the Torrey Botanical Club, is assisting Dr. Becker in the field this summer.

Dr. Herbert N. Gleason, Curator Emeritus, spent several days at the Garden this spring. He completed the second revision of *Plants of the Vicinity of New York* to be published by The New York Botanical Garden.

Dorothy Ebel Hansell, Editor of *The Garden Journal,* viewed the exhibition, "Festival of Flowers," at the Montclair (New Jersey) Museum of Art in which member clubs of The Garden Club of America and of the Garden Club of New Jersey cooperated. Among the many exhibits were merry garden prints by Martin Engelbrecht, loaned by Mrs. Roy Arthur Hunt of Pittsburgh, Pennsylvania. Mrs. Hansell attended World Gardening Day, sponsored by the Garden Club of New Jersey at Montclair, New Jersey, at which Mrs. Z. Marzouk, Director General of Social Concerns and Labor of Alexandria, Egypt, and a member of the Assembly of the U.A.R., gave an illustrated talk on gardening in her country; and was a guest at the garden party and luncheon that was tendered the National Association of Gardeners by Mrs. Ricardo Gonzales at her estate, "Brookside," Rye, New York. Mrs. Hansell is an honorary life member of the Association.

George Friedhof retired on Arpil 29, 1961, having been in the employ of The New York Botanical Garden since April 1903. Now at the age of seventy-five George (he has never been called anything else) can look back on an almost perfect attendance record. No one can recall that he was ever tardy or absent. A brief ceremony was held at the Propagating Range where George had tenderly cared for seedlings for fifty-eight years. Dr. Steere presented him with a purse, on behalf of the garden, in appreciation of his many years of faithful service.

Reception for Graduates. Dr. Julian A. Steyermark, Botanist at the Instituto Botánico, Ministerio de Agricultura, Caracas, Venezuela, was guest speaker at the reception for graduates in the Two-year Course in Botany and the Two-year Course in Practical Gardening. His topic was "A Botanist's Impressions of Gardens in the American Tropics."

The reception was held in the Ramskeller Room in the Campus Center Building at Fordham University on the evening of June 20, 1961. T. H. Everett, Assistant Director (Horticulture) and Curator of Education, addressed the graduates and their relatives and friends.

Frederick S. Moseley, Jr., Vice President of The New York Botanical Garden, presented certificates to: Concetta Di Pietro, Richard T. Downes, Bess Hamers, George B. Stanton, and Elizabeth Wunder who had satisfactorily completed the Two-year Course in Botany; and to Charles Baiano, Curt Hagen, Jr., Greta Karppi, Rosalie Leslie Loreto, Dominic Michael Mascio, Robert H. K. Murray, Jennie Musci, Zelda Schwartzberg, Biondino R. Serpone, George B. Stanton, Dorothy O. Steere, and Samuel Weinstock on the satisfactory completion of the Two-year Course in Practical Gardening.

Staff Seminars. Dr. William C. Steere, Director, discussed "Botanical Activities in Argentina" at the March seminar; Dr. Howard S. Irwin and Dr. Stephen S. Tillett, Research Associates, "Field Activities in South America, 1960" at the April seminar; Dr. David J. Rogers, Curator of Economic Botany, "Systematics of *Manihot esculenta* and Allied Species" at the May seminar; Dr. Julian A. Steyermark of Caracas, Venezuela, on "The Botanical Institute and the Botanical Garden and Parks in Caracas" at the June seminar.

Gift to the Library. A folio of specimens collected in 1805 by John Torrey on a western trip with Thomas Faile, was presented to the Library by Mrs. Lynette Scribner. It had been in the possession of Miss Edith Faile, Faile's granddaughter.

Visitors to the Garden. Within recent months the following have visited the Garden:

Dr. H. Radcliffe Roberts, Director, The Academy of Natural Sciences, Philadelphia, Pa.

Dr. Ruth Patrick, Chairman, Department of Limnology, The Academy of Natural Sciences, Philadelphia, Pa.

Prof. André Aubréville, Museum National d'Histoire Naturelle, Paris.

Henry F. du Pont, Winterthur, Del.

Joseph Swan, Farmington, Conn.

Dr. Jerry Walker, Plant Pathologist, Brooklyn Botanic Garden, Brooklyn, N. Y.

Drs. Marion Wilson, Oswald R. James, Clark F. Begg, St. Luke's Hospital, New York, N. Y.

Dr. Aoishima, Government Forestry Experiment Station, Tokyo, Japan.

Dr. S. F. Kudzin, Clemson, S. C.

Carl Schiff, Horticulturist, Department of Parks, City of New York.

Dr. José Jiménez, Santiago, Dominican Republic.

The American Iris Society, at the special exercises held at The New York Botanical Garden on May 26, 1961, to commemorate the founding of the Society at the Garden, presented citations to Dr. Henry A. Gleason, Head Curator Emeritus, Mrs. Ethel Anson S. Peckham, Honorary Curator of the Iris and the Narcissus Collections since June 1927, and Dr. John C. Wister. The presentation was made by Robert Carney, of Memphis, Tennessee, Vice President of the American Iris Society. The citation to Dr. Gleason follows:

Henry A. Gleason, as Assistant Director of The New York Botanical Garden encouraged John C. Wister in his efforts to create a society devoted to iris, giving him the names of individuals who would be helpful in the movement, organizing the events at the Garden—the morning meeting, the luncheon, and the afternoon session on January 29, 1920—and enlisting the interest of the Director, Dr. Nathaniel Lord Britton, in setting aside a plot of ground at The New York Botanical Garden for irises and in providing for the development and maintenance of the extensive iris collection which became the first trial garden of the American Iris Society in 1920.

To Dr. Gleason, famed botanist, author, teacher, the American Iris Society, on this forty-first anniversary of its founding at The New York Botanical Garden, presents this citation in grateful appreciation of his interest and cooperation.

T. H. Everett, Assistant Director (Horticulture) presided at the ceremonies. Dr. William C. Steere, Director, welcomed the members to the Garden. Dorothy Ebel Hansell, Editor of *The Garden Journal,* a Vice Chairman of the Convention Committee of the American Iris Society, was responsible for the editing and the printing of the convention program booklet.

Henry Teuscher, retiring Curator of the Montreal Botanic Garden, is developing a new botanical garden in Birmingham, Alabama, which he has designed. He has given lectures in that city on window boxes, and residents have become enthusiastic about them and want to decorate their city with beautiful window boxes. This is a result of Mr. Teuscher's book on *Window Box Gardening,* which was developed from his work in Montreal in which a large segment of that city took part.

The Arnold Arboretum is getting a much-needed greenhouse range, considerably larger than the one erected in 1928. It will have innovations to facilitate plant propagation and horticultural research. Included in the main building will be a research laboratory, a conference room, and three fifty-foot greenhouses of aluminum construction with automatically controlled environmental areas. Walk-in cold-storage rooms, to augment investigations in seed storage and research in plant hardiness, will offer temperature ranges to —20°F. An added feature is a large pithouse for the winter storage of woody plants; this will be automatically controlled by heating and cooling units so that a uniform temperature near the freezing point can be maintained from October to May. A saran-cloth shadehouse for evergreens, plant frames, and a nursery will surround the buildings and provide one hundred per cent more plant growing space. The collection of a hundred different kinds of hedges will be relocated near this greenhouse area. A collection of dwarf conifers will be located around an hexagonal redwood display house in which the valuable Larz Anderson collection of century-old Bonsai plants will be featured.

The greenhouse range was designed by Griswold, Boyden, Wylde, & Ames, Architects. Ground-breaking ceremoniees on May 12, 1961, were held at the site where the new greenhouse range will be erected. Among those present were President Nathan N. Pusey of Harvard University; Dr. George Taylor, Director of the Royal Botanic Gardens at Kew, England; Dr. Philip A. Munz, Director Emeritus of the Rancho Santa Ana Botanic Garden, Claremont, California; Dr. John M. Fogg, Jr., Director of the Morris Arboretum of the University of Pennsylvania; Oliver Wolcott, President of the Massachussets Horticultural Society; Henry F. du Pont of Winterthur, Delaware, a member of the Board of Managers of The New York Botanical Garden; Dr. Richard A. Howard, Director, Dr. Donald Wyman, Horticulturist, and others of the Arboretum's staff.

All-America Rose Selections announce that four roses have won the 1962 AARS award: 'Christian Dior', a Hybrid Tea, bears large crimson-red flowers. 'King's Ransom' is the first yellow Hybrid Tea to win AARS honors since 1950. 'Golden Slippers' is a color break in the Floribunda class. Its bright gold buds are flushed with red; the upper petal surface of its good-sized flowers are orange-vermilion, the lower surface a rich gold. 'John S. Armstrong' bears its velvety, deep red flowers (up to four inches across when fully opened) in clusters, but on long individual stems ideal for cutting.

Visitors to the Rose Garden of The New York Botanical Garden on Rose Day, June 13, 1961 saw forty All-American Award Winners among the many varieties that grace the beds and borders. Guides through the Rose Garden were led by Dr. A. D. Mollin, Peter Kooy, Dr. Cynthia Westcott, and Edward O'Keefe.

Dr. A. D. Mollin's hobby of twenty years has been growing roses at his home and dental offices in Great Neck, Long Island. He has won more than one hundred awards, including medals. He is a member of the American Rose Society, has written for the *American Rose Magazine,* and taught a class on "Roses and How to Grow Them" this spring at the Garden. Peter Kooy joined Bobbins & Atkins in Rutherford, New Jersey, in April, 1911, coming from Hillegoom, Holland, and remained with them until

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Top row. Southern slope of Altiplanicie de Nuria. The abrupt point at the left, known as El Picacho, was climbed by the expedition. A cloud-forest covers the summit at an elevation of two-thousand feet.

Second row, left. Altiplanicie de Nuria. View from rocky point of El Picacho on the vast extent of lowland forest and savanna.

Second row, right. In mid-background, El Picacho can be seen. View in savanna on the summit of Altiplanicie de Nuria.

Third row, left. The summit of Altiplanicie de Nuria at an elevation of fifteen hundred feet. Showing savanna and moriche palm areas in western section and upraised edges of escarpment rising to two thousand feet along the Altiplanicie.

his retirement in 1958 after a lifetime with roses. He was superintendent of the rose department, supervising budding, storing, and filling rose orders, and still had time to give friendly advice to customers who visited the nursery. Dr. Cynthia Westcott, nationally known as "The Plant Doctor" is an ardent rosarian, lecturer, writer for magazines and newspapers, and author of a number of books. Edward J. O'Keefe is superintendent of the Mrs. M. Neuberg estate of White Plains, New York. He is well known as a flower show judge, is an instructor in the Educational Program of The New York Botanical Garden, and is especially interested in single roses.

Guiana Exploration. Another phase of The New York Botanical Garden's ten-year Guiana Program of exploration was recently brought to conclusion through the efforts of Dr. Julian A. Steyermark of the Instituto Botánico, Caracas, Venezuela. He conducted for the Garden, in collaboration with the Instituto Botánico of the Ministerio de Agricultura y Cria, a series of expeditions which lasted from mid-October, 1959, until February 18, 1961, into the Sierra Imataca, Altiplanicie de Nuria, and areas in the Delta Amacuro Territory south of the Orinoco River. This is a region of heavily forested country which extends east into British Guiana. The Altiplanicie de Nuria is an elevated, mainly densely forested terrain, whose escarpments, attaining an altitude of two thousand feet, are capped by cloud forests. Between these escarpments, the Altiplanicie has the form of a depressed basin, covered by savanna and moriche palm areas in the western part, but eventually being covered by continuous forest eastward. The Altiplanicie divides the streams flowing northward into the Orinoco and those flowing southward into the Cuyuni drainage. Many trees and other elements of the flora encountered in this area were found to be species known previously from the Guianas, or from northern Brazil, but not previously recorded from Venezuela.

In order to cover this extensive region, the

expedition penetrated into four different areas, establishing new camps in each section. First, by foot and by dug-out canoe, the Rio Amacuro, which borders British Guiana and Venezuela, was botanized somewhat above the region of San Victor. Then, the Cuyubini and Acure rivers, which also flowed northward into the Orinoco River, were botanized during the remainder of a month's exploration into this Delta Amacuro Territory. A three-week overland journey, with the equipment moved by burros and Indian carriers, was made into the Rio Toro section as far as the Rio la Reforma. This is a rugged section of the Imataca Mountains. The final month and a half was concentrated on the western and southern portions of the Altiplanicie de Nuria.

The Orinoco Mining Company, through the courtesy of Fred Wright, facilitated the travel down the Orinoco River by means of a launch. This greatly aided the expedition's reaching the mouth of the Rio Amacuro.

Altogether, approximately fourteen thousand herbarium specimens, consisting of twenty-two hundred and fifty numbered collections, were obtained in this period of exploration. Dr. Steyermark arrived at the Garden the latter part of April and will spend four months in research on Guayana members of the *Rubiaceae* collected by expeditions of the Garden. He will then return to the Instituto Botánico at Caracas.

"Focus on Home Gardening 1961." Several hundred home gardeners gathered in Town Hall, New York City, on May 11, 1961, to discuss garden problems and techniques with a panel of experts. On the panel were Mrs. Ruth Alampi, TV and radio personality; Dr. George S. Avery, Director of the Brooklyn Botanic Garden; Ralph Bailey, Garden Editor of *House and Garden;* Mrs. Helen S. Hull, Past President of the National Council of State Garden Clubs, lecturer, and author; James S. Jack, Superintendant of "Brookside," Rye, New York; Dr. Ordway Starnes, Associate Director of the New Jersey Agricultural Experiment Station; Edwin F. Steffek, Horticultural Editor of *Popular Gardening,* and Dr. H. L. Haynes, Technical Manager of Biological Products, Union Carbide Corporation. Similar seminars will be held under the sponsorship of Union Carbide Corporation in major cities of the United States.

Syracuse Forestry College dedicated its forty-six-year-old wood collection as the Harry Philip Brown Memorial Wood Collection, in honor of the former faculty member who was the founder and curator of the collection for thirty-five years. It ranks among the few extensive validated wood collections in the world and includes almost twenty thousand specimens. North and South America are most completely represented. The dedication took place during the three-day celebration of the golden anniversary of the State University College of Forestry at Syracuse University.

Dr. Hardy L. Shirley, Dean of the College of Forestry, announced during the celebration that a 1,000-curie, Cobalt-60 source for use in radiation research had recently been installed at the college. It will be used as a source of energy in chemical reactions and will be part of the research facilities of the Forest Chemistry Department under Dr. Conrad Schuerch, Chairman. It was obtained through a grant from the Atomic Energy Commission, under which Dr. Vivian Thomas Stannett, Dr. John A. Meyer, and Dr. Michael M. Szwarc will direct research on ionic polymerization.

A number of leaders in forestry and conservation participated in the observance of the fiftieth anniversary of the College of Forestry: Prof. Eino Saari of the University of Helsinki, Finland, and Honorary President of the Fifth World Forestry Congress; Richard E. McArdle, Chief of the United States Forest Service; Conrad L. Wirth, Director of National Park Service; Laurence Rockefeller, Chairman of the Outdoor Recreation Review Committee; Dr. Harold G. Wilm, New York State Conservation Commissioner; Dr. Irving W. Bailey, Professor Emeritus of Botany of Harvard University; Dr. Ellwood S. Harrar, Jr.; Dean of the School of Forestry of Duke University; Orville W. Spicer, President of The Bartlett Tree Expert Co., and others.

Mohonk Garden Holiday, September 5-9, 1961, at Lake Mohonk Mountain House, in Ulster County, New York, offers nature walks, workshop in flower composition, lecture-demonstrations in flower arranging, lectures on garden maintenance, plant material, and procedures in horticultural exhibition. The lecturers are Mr. and Mrs. Henry Downer, Alice Dustan Kollar, and Marjorie V. Barton. Full details may be had from Ruth H. Smiley, Program Chairman, Mohonk Lake, New York.

The American Boxwood Society is being organized, and interested parties may address Dr. Walter S. Flory, Curator of the Orland E. White Research Arboretum, Boyce, Virginia. The Research Arboretum is a unit of the University of Virginia's seven-hundred-acre Blandy Experimental Farm. A number of amateur gardeners, eminent horticulturists, nurserymen, and others decided such a society would be desirable for the exchange of information on the species and varieties of *Buxus,* on their propagation and uses in planting, and on control of the few pests that attack boxwood.

Laboratory-Administration Building for the United States National Arboretum. Funds for the building were provided by Congress last fall; construction is expected to start this year. According to Dr. Henry T. Skinner, Director, the two-story building of contemporary design will provide offices and laboratories for the research staff, a library, space for plant processing and recording, and study rooms for visiting researchers. There will also be a herbarium with capacity for more than a million specimens. The auditorium wing will be surrounded by a reflecting pool, which will provide a habitat for aquatics and also serve the building's air-conditioning system.

Also scheduled for construction at the National Arboretum are permanent residences for a guard and for the superintendent of greenhouses, remodeling of two vehicle entrances, a pedestrian gate, and additional parking space for one hundred and fifty cars. The total cost is expected to be a million and a half dollars; construction will be completed about mid-1962. Five greenhouses are being constructed.

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ing, which includes a collection of boxwood —will furnish bloom interest in mid-May from the peonies, in July from the hemerocallis, and all-season interest from the boxwood. The peonies were donated by the American Peony Society, the hemerocallis by the Hemerocallis Society of America, and the boxwood by plant breeders and nurserymen.

The Sixteenth International Horticultural Congress will be held in Brussels, Belgium, August 31-September 8, 1962. It is interesting to note that the First International Horticultural Congress was held in Brussels in April, 1864; with a mere twenty months ahead of the actual date, it will be possible to celebrate the centenary of the International Horticultural Congresses in the very town where they originated.

The First Congress, organized in connection with the Universal Horticultural Exhibition, was a remarkable success. A large number of experts from all the European countries, came to the conclusion that horticulture could be considered "not only as an art (perhaps even a science), but also as a trade and an industry." The general secretary of the First Congress, which was organized by the Féderâtion des Sociétés d'Horticulture de Belgique, was Edouard Morren, Professor of Botany at the University of Liège and well-known editor of *La Belgique Horticole*, a remarkable nineteenth-century journal on gardens, glasshouses, and orchards. The 1864 Congress brought together a large number of horticultural experts and botanists; among them was Dr. Von Siebold, the famous explorer of Japan.

Several other International Congresses were organized: Ghent, 1883; Paris, 1885 and 1889; and Chicago 1893. However, it was only in the early twentieth century that a committee was set up to organize International Horticultural Congresses at regular intervals. The more recent congresses organized by this committee were held in London (1952), Scheveningen (1955), and Nice (1958).

The International Committee for Horticultural Congresses meeting in Nice on April 15, 1958, decided to entrust Belgium with the organization of the Sixteenth International Horticultural Congress in 1962, thus increasing the interval between Congresses from three to four years. The Brussels Congress is being organized under the auspices of the International Society for Horticultural Science, which was founded in April, 1959, and has taken over the activities of the International Committee for Horticultural Congresses.

The Congress Secretariat is located at the State Agricultural College, Coupure links, 235, Ghent, from which further information can be obtained.

International Horticultural Exhibition will be held in Hamburg, Germany, from the end of April to the middle of October, 1963. In October, 1953, when the International Exhibition closed, about five million visitors had seen the horticultural achievements of eighteen nations. Eighteen nations have consented to participate in the 1963 exhibitions, and negotiations with another thirty-five nations are under way. The exhibition area will be double that of the 1953 exhibition, and an attendance of ten million is anticipated. Information may be obtained from K. Passarge, Chairman of the Administration of the International Horticultural Exposition, I.G.A., Planten un Blomen, Hamburg, 36, Germany.

BOTANICAL BOOKS (from page 142)

morphics of the Canadian Shield, have now become refined through the more sensitive and more accurate methods of potassium-argon and rubidium-strontium dating. Results of radioactive dating in northern, east-central, and southwestern Minnesota permit a more conclusive correlation of the basement complex within the state, and also with adjacent Pre-Cambrian features in Ontario, Wisconsin, and Michigan. Since contiguous sedimentaries are rare here and fossils practically absent, these sensitive methods tend to authenticate the earliest geological history of the American continent to a much greater degree than was hitherto possible.

The project, although a geological one, employs highly sophisticated chemical, isotopal, and mathematical analyses based on findings of the past five years. Its results represent a pioneering guide line for future work in other regions of the world. It is to be expected that such areas with a comparable lithology will also be subjected to an age revision by methods now applied to the pre-cambrian of Minnesota.

HERMAN F. BECKER

STUDIES IN PALEOBOTANY. Andrews Jr., Henry N. 487 pages, illustrated, indexed. John Wiley & Sons Inc., New York. 1961. Cloth $11.75

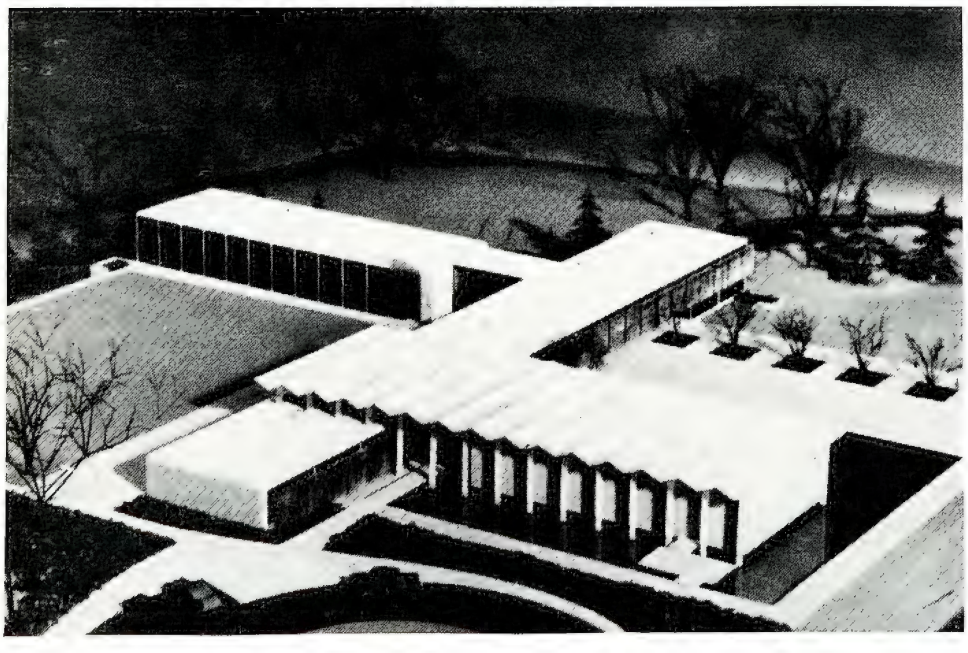
This profusely illustrated study and introduction to paleobotany merits a milestone regarding recent paleobotanical texts. Its eighteen chapters retain something of the conventional sequence but are completely brought up-to-date according to the most recent findings and changes. An introductory chapter on basic principles incorporates the refined potassium-rubidium method for rock dating and the use of modern acceptable hypotheses as they apply to this field. Harold C. Bold's plant classification forms the taxonomic basis for evolutionary sequence. Plant anatomy and wood anatomy, so essential to paleobotanical determinations, are stressed. Zimmerman's telome concept is critically evaluated and the evolutionary thread is followed throughout the book. The reader is gradually but firmly eased into an understanding of a difficult and often controversial subject. Of particular value are expansive chapters on Tertiary floras and fossil plants of the Arctic and Antarctic. Their taxonomic and ecological relationship to modern floras is presented with a characterization, occurrence, and relationship of these floras to each other, and appropriate regional and epochal climate interpretations. The last two chapters present palynology and techniques for studying fossil plants, a long overdue and most useful addition to a modern text.

A glance at the extensive references following each chapter shows that the author drew heavily and profitably on the foremost authorities in this field. Numerous papers are cited from Scandinavia, England, Belgium, France, and even from Hungary and the U.S.S.R. The majority of these references are very recent suggesting the rise of a most active and progressive generation of paleobotanists, especially in the United States.

The book is attractively designed with large and clear print and is adorned with numerous pertinent charts, drawings, and photographs. Its only drawback appears to be the price.

HERMAN F. BECKER

The architect's model of the administration-laboratory building for the United States National Arboretum, Washington, D. C.



RECENT BOOKS (from page 142)

grouped so as to correspond with the main events of Thoreau's life. This edition includes a new preface, notes, and introduction.

GARDEN PLANTS AND LAWNS

FLOWERING CACTI AND OTHER SUCCULENT PLANTS. Rose, H. 100 pages, illustrated. Sterling Publishing Co., New York. 1960. $2.50

Brief descriptive and cultural notes with forty full-color photographs should interest the budding cactus and succulent plant enthusiast.

GARDEN SHRUBS AND TREES. Harrison, S. G. Key to Genera by R. D. Meikle. 318 pages, illustrated (part colored), indexed, bibliography. (The Kew Series) St. Martin's Press, New York. 1960. $4.95

A fine little work of excellent color plates and line drawings and authoritative text in non-technical language. The Kew Series are written by members of the botanical staff of the Royal Botanic Gardens, Kew.

THE GOLDEN GUIDE TO LAWNS, TREES AND SHRUBS. Strohm, John, ed. 176 pages, illustrated (part colored), indexed. Golden Press, New York. 1961. $1.00

Inexpensive paper back with good regional sections. The contributors, well known in horticultural circles, are John Strohm, Milton Carleton, Arnold M. Davis, John Hill, William Weers, Charles J. Hudson, Richard D. Westcott, and Dean Collins.

THE LAWN BOOK. Schery, Robert W. 207 pages, illustrated, indexed. The Macmillan Co., New York. 1961. $5.95

Dr. Schery, who is Director of The Lawn Institute at Marysville, Ohio, presents the very latest findings on lawn preparation and care. Especially good are the illustrations of weeds. Recommendations are given for various climatic conditions throughout the United States.

MINIATURE ROSES. Genders, Roy. 104 pages, illustrated (part colored), indexed. St. Martin's Press, New York. 1961. $3.95

From England comes this first book devoted entirely to miniature roses, with sections on their history, propagation, descriptions, and culture.

ROSES; GROWING FOR EXHIBITING. Allen, Harold H. 175 pages, illustrated, indexed. D. Van Nostrand Co., Princeton, N. J. 1961. $4.95

The author has won numerous blue ribbons, sweepstake trophies, and national awards. The first half of the book deals with rose growing, and the rest is devoted to flower show exhibiting and judging.

IDEAS FOR ENTRYWAYS AND FRONT GARDENS. Sunset Books, Lane Book Company, Menlo Park, California. 1961. $1.50

Sunset Publications has answered parking and planting questions in a fresh, interesting manner in their new book *Ideas for Entryways and Front Gardens*. For a nation on wheels, their numerous illustrations and short concise descriptions turn a parking problem into an attractive way welcoming guests into a garden picture setting.

In some instances, screens and planting give privacy and subtilely lead to the entrance. In other instances, the street side of the property is boldly turned into an open shaded parking area of patterned pavement with a foliage background.

Some of the pictures would be more useful if accompanied by simple layout plans to show the scale, proportion, and relationship of the paved and planted areas.

In the section on steps there are a few illustrations of formal treads and risers with adjacent slopes of rock piles that do not harmonize. Perhaps vines will erase this unrelated mixture in time.

The few illustrations of cute, busy, and cut-up areas are fortunately in the minority. If readers in the northern part of this country remember that the use of wood is better suited to a dry climate than to their own more moist conditions, they will find this book filled with useful ideas.

ARTHUR F. MURPHY, L. A.

THE CAMELLIA. Urquhart, Beryl Leslie, Ed. The Leslie Urquhart Press, Sussex, England. Vol. I, 1956. Vol. II, 1960. $16.50 per volume.

We have here the first two volumes of a monograph done in the tradition of the "Great Flower Books" of the eighteenth century and the first half of the nineteenth century, that is, accurate reproduction of the subject combined with the best possible decorative arrangement on the page. The superb life-size paintings by Paul Jones and Raymond Booth are reproduced in eight-color litho-offset on the finest hand-made paper. The eminently readable and authoritative text contains notes on each of the plants. Volume I is given over mostly to *Camellia japonica* cultivars, while Volume II features the first fine artist's paintings of the magnificent "Yunnan Reticulatas." Volume I is nearly exhausted, the publishers report, and is already being spoken of as a rare book.

The paintings are available separately in unbound sets. CHARLES C. CLARE, JR.

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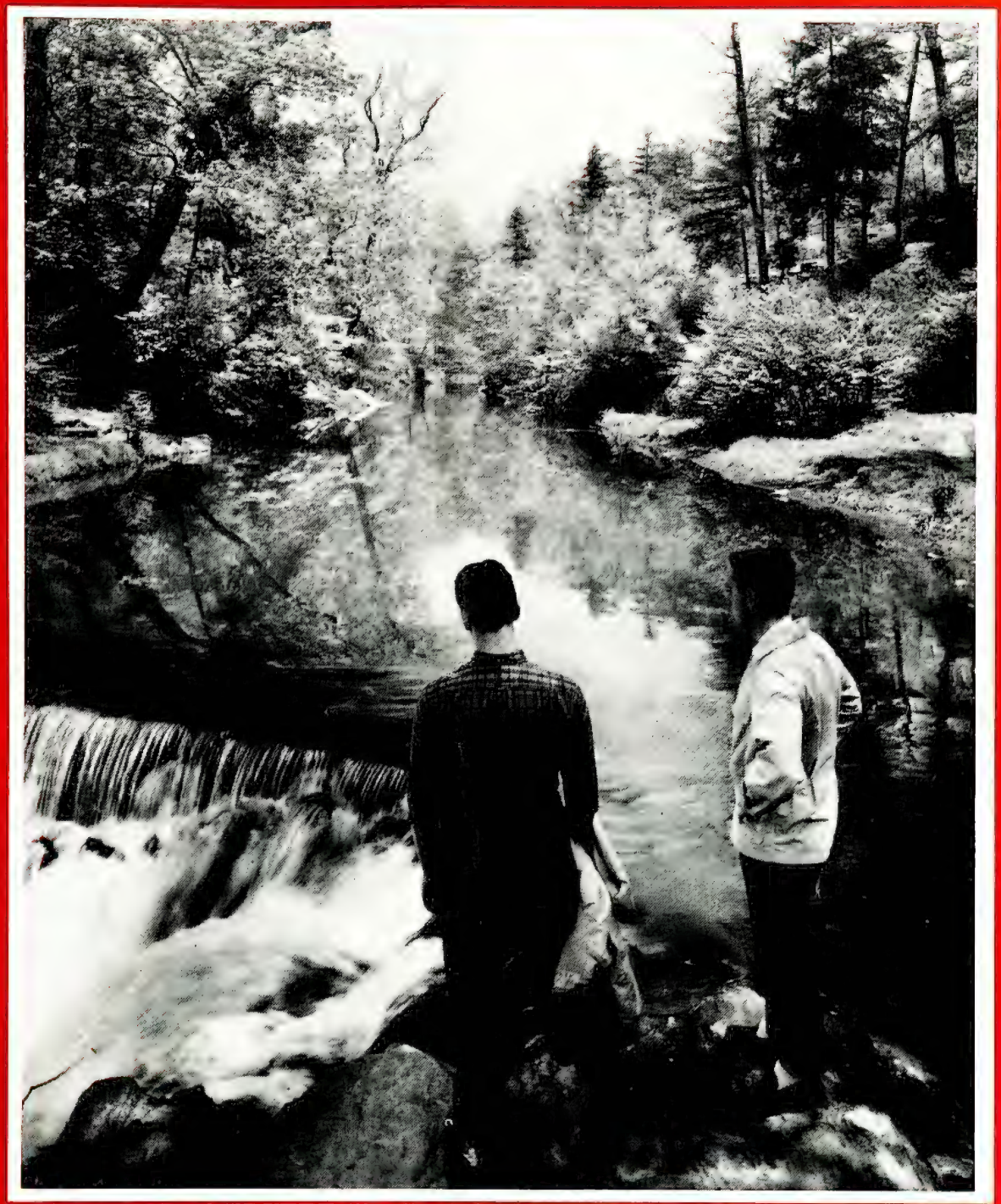

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THE GARDEN JOURNAL

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Vol. 11, No. 5 September-October, 1961

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DOROTHY EBEL HANSELL
Editor

CALENDAR

September 15-17, 1961. Penn-Jersey District Meeting and Rose Show at the Hotel Suburban and the Colonial Life Insurance Company Building, Prospect Street, East Orange, New Jersey.

October 20-22, 1961. Eighteenth Annual Meeting and Show of the National Chrysanthemum Society, Inc., U. S. A., Garden City, Long Island.

October 25-27, 1961. Sixteenth Annual American Horticultural Congress, Northampton, Mass.

November 3, 1961. Chrysanthemum Show opens in the Conservatory of The New York Botanical Garden.

December 7, 1961. Holiday House Tour, sponsored by the Volunteer Associates of The New York Botanical Garden.

December 14, 1961. Theater Benefit, "Gay Life" at the Shubert Theater, sponsored by the Volunteer Associates of The New York Botanical Garden.

January 4, 11, 18, 25, 1962. Downtown Lecture Series, sponsored by the Volunteer Associates of The New York Botanical Garden.

April 27-May 7, 1962. Floralies, International Horticultural Exposition under auspices of Société d' Horticulture and Jardin Populaires de France in Valenciennes, France.

August 31-September 8, 1962. Sixteenth International Horticultural Congress, Brussels, Belgium.

April 26-October 1, 1963. International Horticultural Exposition, Hamburg, West Germany.

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While every effort is made by the Editor to avoid errors, the ultimate responsibility for all statements rests with the authors.

CREDITS FOR ILLUSTRATIONS

We are indebted to the Display Committee, Mrs. Charles Burlingham, Chairman, for the selection of the front cover illustration—the Bronx River in The New York Botanical Garden by Gottscho-Schleisner, Inc.; pp. 153-157, Natalie H. Davis; p. 159, Charles C. Clare, Jr.; pp. 162, 163, E. W. Lyle; p. 164, Rutgers, The State University; pp. 165-167, Sir Oliver Leese; p. 168, University of Washington; pp. 170-176, Julian A. Steyermark; p. 178, J. Horace McFarland Co.; p. 179, The New York Botanical Garden; p. 180, upper, Donald F. Merrett, from the Spingarn Collection; lower, The New York Botanical Garden; p. 181, Arnold Arboretum; p. 182, E. N. Mitchell; p. 184, Weecarr—courtesy of J. R. Henderson; p. 188, 190, E. N. Mitchell.

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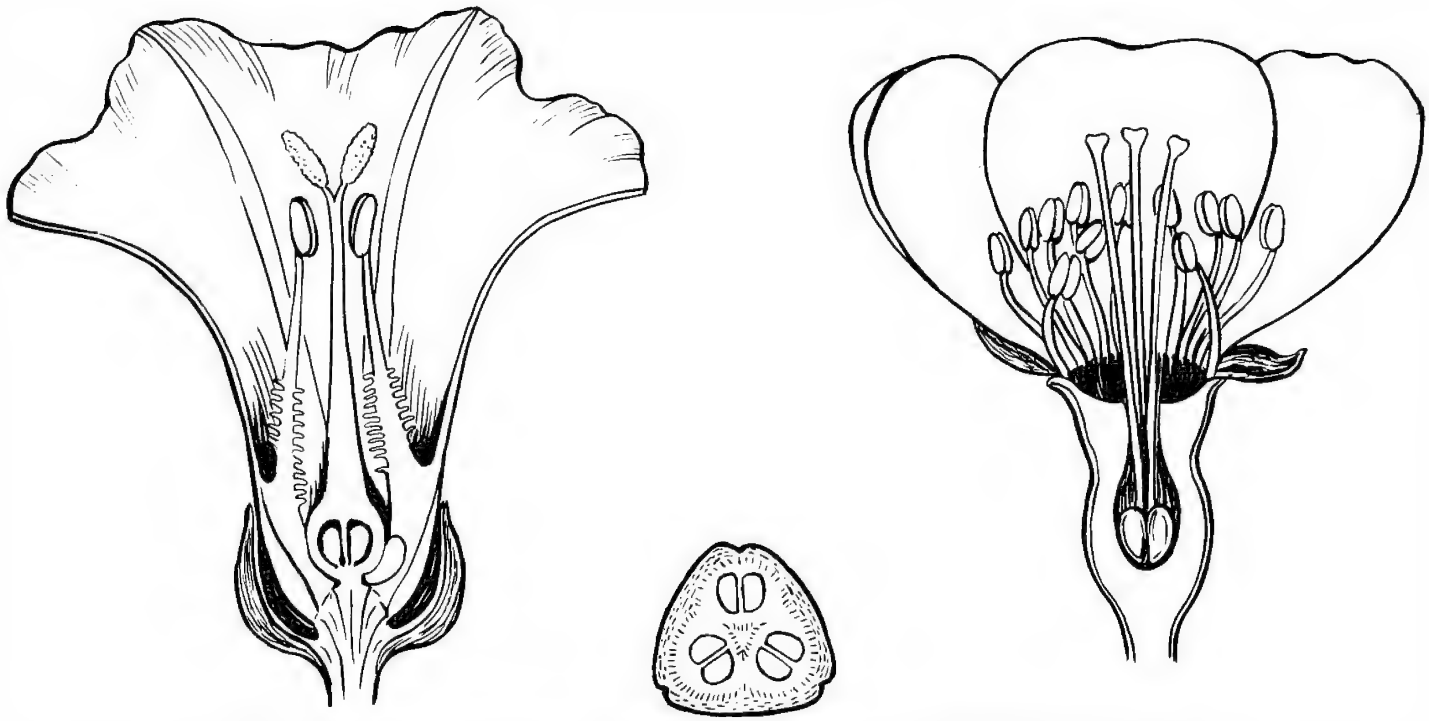


Contour: Left. Longitudinal section of a *Convolvulus* flower. Center. Cross section of a tulip fruit. Right. Longitudinal section of a pear blossom.

DESIGN IN FLOWERS AND PLANTS

By NATALIE H. DAVIS

Before coming to the University of Illinois as staff artist in the Botany Department, Miss Davis free-lanced in New York in the field of botanical and horticultural illustration, working for publishers of books and magazines, both scientific and popular.

At the University of Illinois a technique of painting in water color was developed for careful studies of flower and plant parts, greatly enlarged, and these illustrations, or "charts," are used as teaching aids in the botany lectures. From the artist's angle, this opportunity to study plant structure and microscopic parts closely turned into a voyage of personal discovery of ever-present design, and one result was to give talks to garden clubs around Chicago and other cities. This is the basis for those talks.

A hobby of wood-block printing took Miss Davis to Japan last summer to study the Japanese method of block printing.

THE IDEA THAT nature is the great designer is hardly new to any of us; even a school child is familiar with the exquisite and infinitely varied designs in snow crystals. But few people beside the botanist and botanical artist know the incredible wonder and beauty of the inner structure of flowers.

Flowers and plants have been used as design through the ages, ever since man decorated anything. The artist seems to have had a passion for flowers, and after long use as a design motif the flower or plant often became a national emblem. The Egyptian lotus is one of these—the water-lily which to the Egyptians had much sacred symbolism. With its roots in the mud and its exquisite blossom rising above the surface of the water and daily opening to the sky at the bidding of the sun, it became a symbol of the sun, of the spiritual life and of immortality. Bouquets of lotus blossoms were given to guests at funerals. As the national flower of Egypt the lotus motif was used superbly in architecture, both carved and painted; it was wrought in jewelry, and reproduced in the decoration of pottery. Probably because of its adaptability as a design motif it has also been used in India, China, and Japan, in each taking on the individual nation's symbolism.

The beauty of leaf design also has long been recognized. In Romanesque architecture of the eleventh century, column capitals were sometimes adorned with sculptured leaves which were carved with such fidelity that they are acceptable even to the botanist. Those of the cathedral at Cluny are a notable example. The acanthus, immortalized by the Greeks, is very familiar in architectural details right up to the present day. There is a legend that the source of the design motif of the well-known Corinthian capital was the acanthus leaf in the center of which it was customary to place a funeral offering. Whether or not this is true, it was natural to use the leaves of this handsome plant which grows profusely in the Mediterranean region. After hundreds of years the acanthus motif had a special renaissance at the time of Louis XIV, XV, and XVI in France; it appears in architecture, furniture and decorative objects of every kind.

The French fleur de lis also has had a long history. There probably will always be an argument as to whether the lily or the iris was the origin of this emblem. However, the design seems to point to the iris; and it is said that when a Frankish king was proclaimed, he was elevated on a shield, and a spray of blooming "marsh lily," another name for one of the irises, was placed in his hand. The fleur de lis has been used by every kind of artist and craftsman, in heraldry, textiles, furniture, and jewelry. It has seen many changes and adaptations, and it is still an unusually lovely emblem. This is also true both of Turkey's tulip, which is seen slightly stylized in porcelain and fabrics, and of the pomegranate, a fruit that is mentioned frequently in the Bible as adorning priests' robes and architectural columns. It is said to have been the source for the design of Solomon's crown. The tulip ultimately became the national flower of Turkey and the pomegranate that of Spain.

The Aim of the Botanist and Botanical Artist: To Understand Nature

In all this use of the plant as a source of design in decoration, nature is being adapted to man's will and to that degree exploited. In botany, on the other hand, and in botanical illustrating, the aim is to discover the ways of nature —to know the structure and functions of the plant, and its usefulness. In so doing the seeker is also struck by the beauty of design.

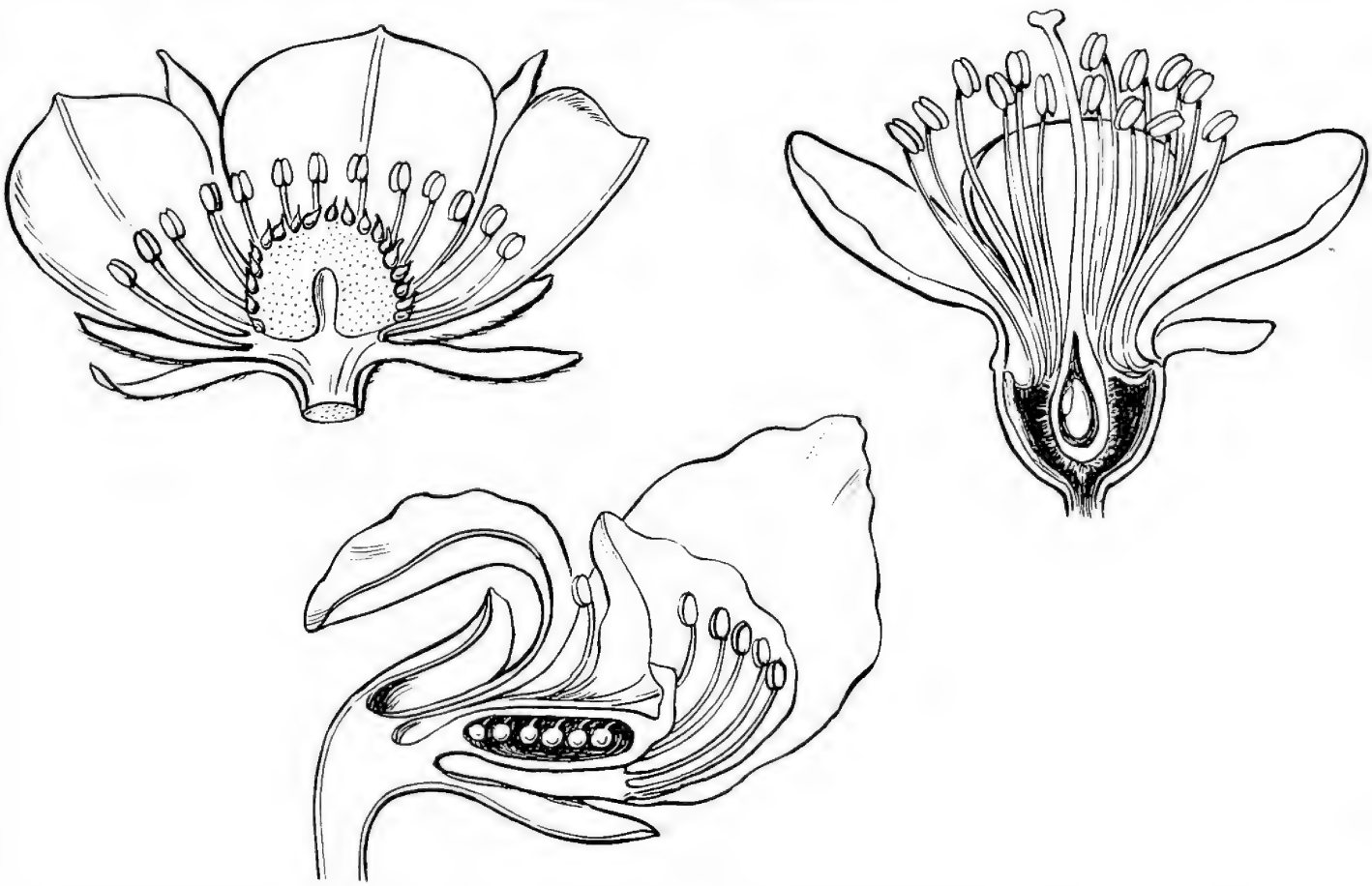
The botanical artist needs to have the Oriental attitude toward nature. Kuo Hsi writes on landscape painting, "The artist must place himself in communion with his hills and with his streams." In like manner the ancient Chinese painter of flowers (and the Chinese, perhaps, are considered the best nature painters of all time) sought to enter into the life of the plant, to be an interpreter of nature. We are told their method of work was to make countless sketches of a flower or plant, from all angles, and at all times of day, until they thoroughly understood the plant; then to discard all sketches and make the final drawing or painting by heart, by their inspired memory and understanding. The result was a work of art of extraordinary vitality, not just a reproduction. It was the eternal truth of that flower.

Countless legends tell of the ability of Chinese artists to infuse their paintings with life. One legend tells about an artist's young apprentice who had been disobedient or negligent in his duties; for punishment his master bound him with ropes to a stake. As he wept over his plight, his tears mingled with the soil at his feet, and with his toe he drew a mouse of such realism and vitality that it came to life, gnawed the rope that bound the boy, and set him free.

Method of Work of the Botanical Artist

In order to portray detail and vitality, the first requirement in a botanical artist is that he or she have a genuine passion for flowers, especially since infinite patience is often required. For instance, a floret must be dissected so that no damage is done to the smallest structures. Pains must also be taken to secure fresh material, because a flower or a plant has its own rhythm, or growth habit, that distin-

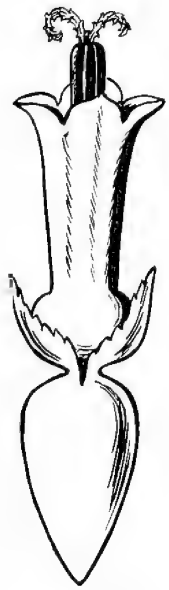
Fruits within flowers: Left. Longitudinal section of a strawberry flower. Center. Longitudinal section of a pea flower. Right. Longitudinal section of a peach blossom.

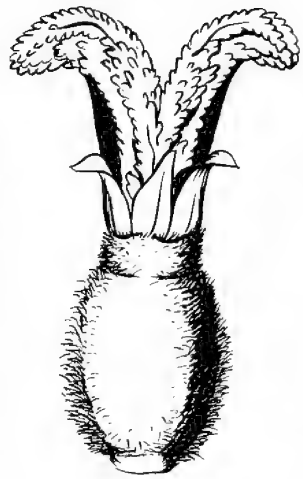


guishes it from any others. This is the architecture of the plant, and much of this structural beauty is lost when the plant is faded, or even a little wilted, or when it is seen only two-dimensionally, as in a pressed specimen. An experienced artist can reconstruct a plant from an herbarium specimen, but the result is inevitably a bit wooden and stiff. Many sketches should therefore be made in order that the live material may be recorded for reference throughout the entire process of painting or other illustrating.

Flowers and plants are restless models: a leaf bends, a petal curls, and in no time the whole structure has a new aspect. In the face of such danger it is a temptation to use a camera, yet the camera is undoubtedly responsible for the lack of outstanding flower illustrations today. Such superb work along some lines is done with the camera that the artist sometimes feels unnesessary. However, there are fields where the camera falls short. No photograph can take the place of the fine line-drawing for scientific books and papers, and even for popular books. Nor can it construct the botanical charts for teaching aids that are studies in color, greatly enlarged, of plant and flower parts. In short, the camera is a highly efficient tool, but so far it does not replace the sensitive hand and the loving heart of the artist.

A world of undreamed beauty of detail opens up to the botanist and botanical artist with the hand-lens and microscope. Indeed, the almost incredible wonder and beauty of design in flower and plant parts can be known only by those who dissect them. Though we turn a flower, large or small, in every imaginable way as we examine it, observing it from above, from the sides, from the back, we still do not know one of the chief components of its beauty, the beauty of the contour; this is hidden until we have made a longitudinal section. Then the exquisite vase-like form is revealed, of such purity of line that it is a keen esthetic pleasure just to look at it. The convolvulus flower and the pear blossom are good examples. Furthermore, within both these lovely forms each individual part is also exquisitely designed. Take one of the tiny disc-flowers of the sunflower. These are crowded together in what we call the "brown center," because, as we look down on the stigmas collectively, they appear to be a brown pincushion; under the microscope each tiny flower of the brown center is a delicate little urn. This urnlike form is also seen in the female flower of the walnut tree and in many other flowers.

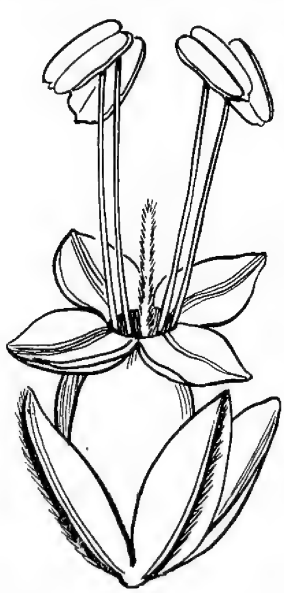


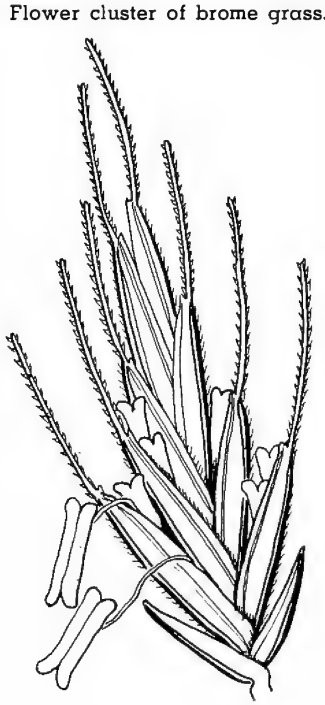


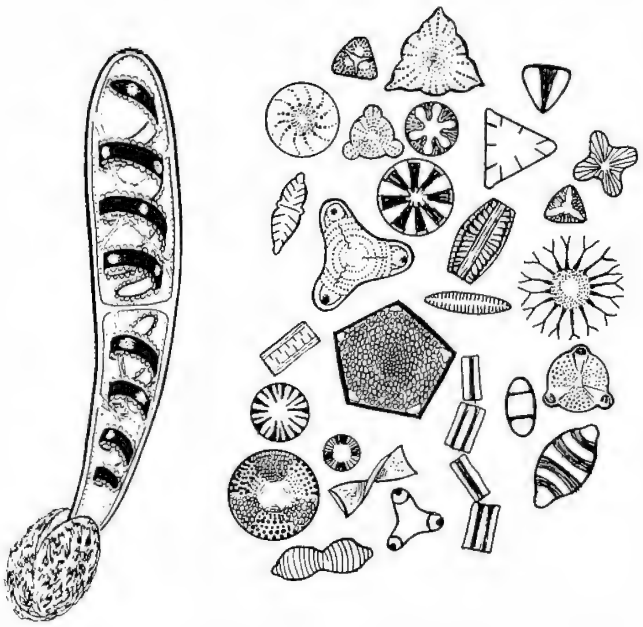
Flower parts.
Left. Disc-flower of sunflower.
Right. Flower of a walnut tree.

There is a Chinese proverb: "All the flowers of all the tomorrows are in the seeds of today." Turn this around to read, "All the seeds and fruits of all the tomorrows are in the flowers of today," and it is still literally true. Looking closely at the base of the style in the peach blossom, we see the ovary which will swell and develop into the succulent peach. On the dome in the center of a strawberry or blackberry flower, one can see many minute pistils, each of which gives rise to a "seed" (to botanists, a small one-seed fruit) with which we are familiar on the surface of the berry. In the pea flower the ovary at the base of the style becomes

Flowers of grasses and weed: Left. Floret of plantain. Center. Flower cluster of Kentucky blue grass. Right. Flower cluster of brome grass.







Algae: Left. *Spirogyra*. Right. Diatoms.

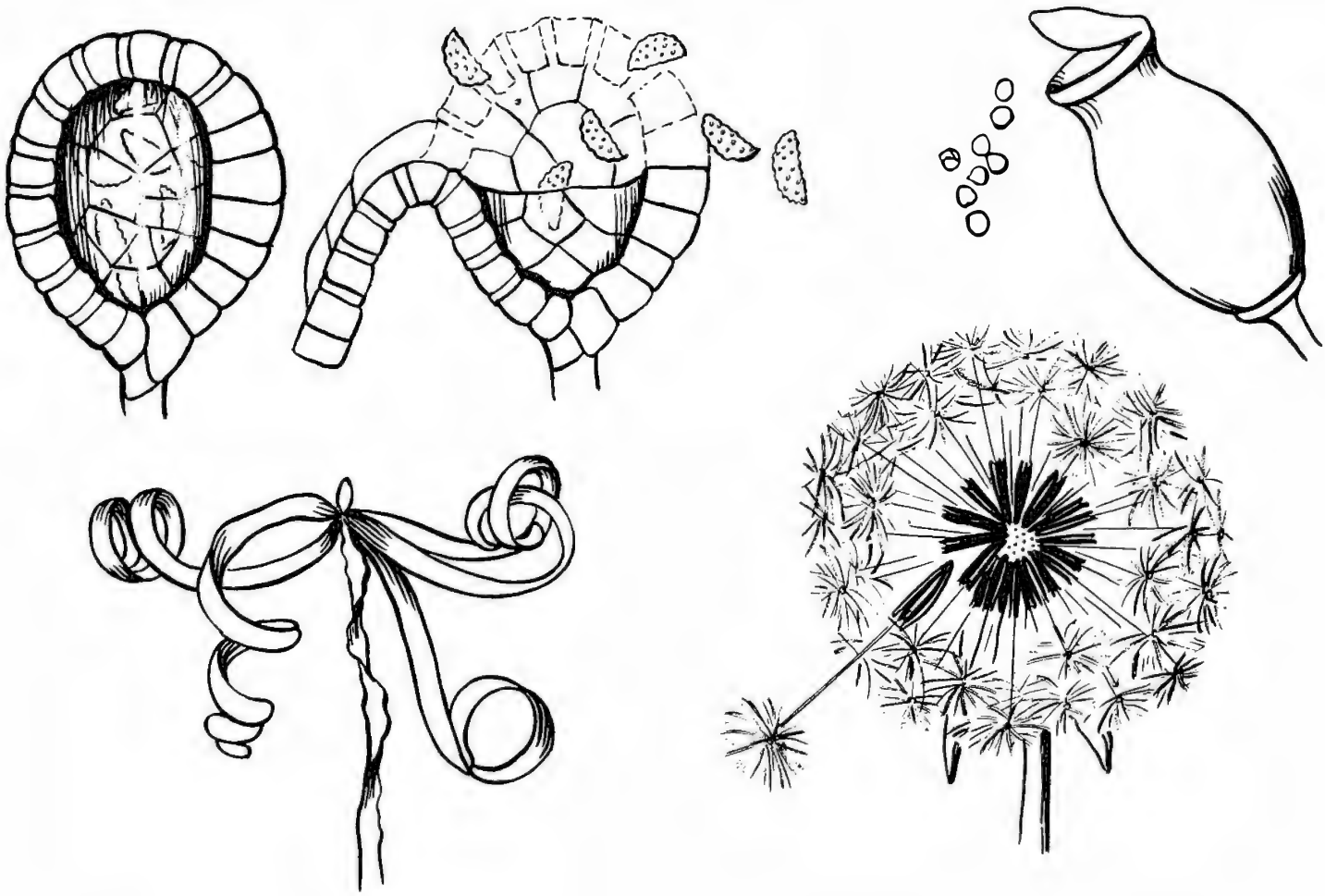
the pea pod, containing the ovules—the future delicious peas. The ovary of the tulip, which will become the fruit, shows when cross-sectioned a balanced triangular design appropriate for a piece of modern jewelry.

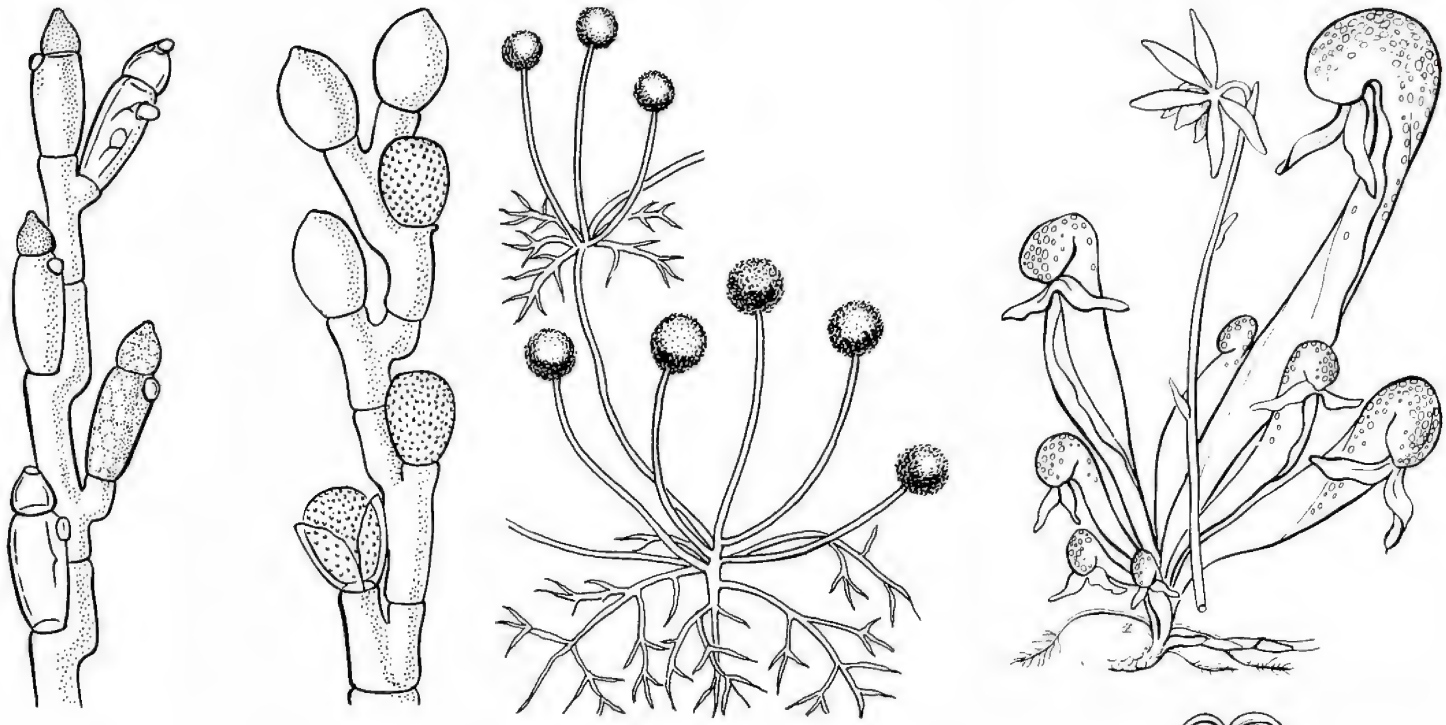
All these and hundreds of others are visible with a hand-lens. Not much greater magnification is required to see the minute flowers of the grasses, perfect in all their parts except that they lack petals and sepals. Grasses are wind-pollinated; they do not attract bees, and they have not developed the showy petals of complete flowers. But even so, the grass flowers are lovely in design. Those of rye and wheat have glistening stigmas like miniature crystal trees, with many branches that are barbed to catch the airborne pollen. As these are extended, their numerous branches catch the light and reflect the colors of the spectrum, like tiny prisms.

Even our old enemy the plantain weed has a flower cluster that is exceedingly lovely; it is made up of small florets, each of which has four tiny petals. These florets are arranged in a spiral, forming the flower head; opening in a succession of bloom from bottom to top, they make the center structure look somewhat like a ruffled pineapple.

As we go deeper with the microscope, marvels of design come to light in spores, pollen grains, and cells. The spore of *Lycopodium,* a little club-moss, is based on a triangle, with finely etched pattern on the tiny shell. In actual size approximately one hundred of these could be put on a pinhead. The pollen grain of the pine is a wonderfully efficient structure. It is equipped with two wind bags to carry

Seed and spore dispersal: Top. Left. Fern sporangium or spore case. Center. Sporangium discharging spores. Right. Spore capsule of hairy-cap moss. Bottom. Left. Seed capsule of *Impatiens*. Right. Dandelion seed head.





Top. Left. Water-mold *(Allomyces).*

Top. Center. A mold *(Rhizopus).*

Top. Right. Cobra plant *(Darlingtonia).*

Right. Pitcher-plant *(Sarracenia purpurea).*

it through the air. Pollen grains, those microscopic structures that in the mass look like yellow flour, are endlessly varied in design; those of the oak and the beech are quite elaborate.

Many of the microscopic structures are as bizarre as Christmas tree ornaments. Indeed, a manufacturer of such baubles would do well to study botany. An alga, *Spirogyra,* covers ponds with scum in spring. It grows under water as bright green strands and rises to the surface as it dies and turns brown. The filaments, like threads of silk, are only one cell wide; the appearance of green comes from an emerald ribbon-like band winding in a spiral around the nucleus of each cell. It appears to be studded with colored stones and to have ruffled edges. *Spirogyra* is constructed in a strangely fascinating way. Other water plants, the diatoms, have myriads of designs and patterns, many of them fantastic, often beautiful. They are the chief component of plankton, the floating mass of microscopic plants and animals, and can be called the grass of the sea, since all the life in the sea feeds on them.

Perhaps one of the strangest of this bizarre group is a mold named *Rhizopus,* a delicately beautiful structure when seen under the microscope, its grape-blue balls balanced on slender thread-like stems with many little rootlets. Even more bizarre is a water-mold, *Allomyces,* a fungus which has two distinct designs, that is, it goes through two entirely different structure-patterns in its life cycle. One of the structure-patterns appears to consist of two-parted, transparent balloons attached to an oddly shaped filament. These balloons contain the male and female gametes which are motile, that is, they have a little tail and can move about. These tiny tadpole-like creatures can be seen squeezing their way out of small apertures in the balloon-like structures. Afterwards they fuse in pairs, then grow "roots," and develop into entirely new orange pear-shaped structures growing on a filament. Merely as abstract shapes these might well repay an artist's study.

Among the most prevalent structural patterns is the spiral. This effective design is seen in algae, in pine cones, in the inflorescence of the plantain, in the pistils of the buttercup, and in the arrangement of leaves in the leafy shoot. Many of the spirals follow a mathematical pattern, an amazing indication of the minuteness with which our universe is ordered.

This Designed Universe

In this close examination of the plant we are constantly impressed by evidence that good design is the result both of sound construction and of definite function. There are many unique contrivances in the structure of a plant, some of which bring about the continuation of life, either in the plant or in its offspring, and each one in itself is an interesting pattern.

The spore case of a fern is a good example. The little

cinnamon-brown dots, or sori, on the back of a fern frond are made up of a cluster of many compact sporangia or spore cases. One of these, when examined, shows a lens-shaped case that contains numerous spores surrounded with a covering of cells. As the spores ripen, the enclosing cover breaks at a weakened spot; the case then springs open and bends backward, forcing the spores to fly out and scatter. When the spore case is splitting, it strongly resembles the casque, or helmet, of the medieval knight.

The seed dispersal mechanisms of *Hamamelis* (witch-hazel) and *Impatiens* (touch-me-not) are also based on an exploding action of great force, and are equally unique in design. In *Impatiens,* after the seeds have been discharged, the capsule winds itself up into many curious spirals like a released spring; these often suggest patterns of skillfully wrought iron.

Both the cross section of a white pine needle and the central portion of a fern stem look like exquisitely designed pieces of complicated machinery, and like machinery their functions are precise. It would be needlessly technical to discuss here the functions of the different bundles of fibers; it is enough to see how beautifully symmetrical they are.

The seed capsule of the hairy-cap moss is designed like a shaker; under the hairy cap we can see the shaker that scatters the spores from beneath its lid.

The dandelion is a marvel of functional design in all of its parts, and to me is a very pretty plant. I am sure if we had to lift it in the fall, or pay a high price for seeds or for young plants in the spring, it would be found in every cultivated garden and purposely placed there. As it is, few beside the botanists realize its functional beauty and perfection. Nature intended this plant to persist, and it has. The rosette of leaves and the large tap root conserve moisture, and the radiating arrangement of the flower head and the seed head is the best possible design for prolonging the life of the plant. We are never at a loss for dandelions.

Probably of all the examples of functional design the most dramatic are the devices whereby insectivorous or carnivorous plants trap insects for food. Since some grow in sphagnum moss bogs where nitrogen is low, they get their supply of nitrogen from the soft parts of the bodies of insects which they digest. One species of pitcher-plant has a curious flower of red or yellow on a long bare stem; but the parts of the plant active in procuring food are the leaves, which are like cornucopias with a pitcher-like lip. This pitcher holds a liquid containing a digestive substance, and the leaf is equipped with downward pointing hairs that permit the insect, attracted by the color or odor, to crawl down, but not up, over them. Unable to get back, after struggling to the point of exhaustion, the insect falls into the liquid and is drowned and then digested by the plant. Both the strange flowers and the pitcher-like leaves are fascinating in design.

Another genus, *Darlingtonia,* has been known as the cobra plant because the hood-like structure on the end of the leaf resembles the dread snake. Thin membrane-like little windows, which allow the light to penetrate the hood, lure the insect to his doom, because he confuses the false windows with an exit.

One especially pretty insectivorous plant is the sundew. It has numerous hairs growing from its leaf blade. The globular head of each hair secretes a sticky juice and shines like a dew drop in the sun, so attracting the insect which is entrapped as the hairs close around it like tenacles.

Even the process of cell division, a miraculous process that is going on in every living thing, makes handsome patterns as chromosomes and other tiny structures within the cell go through the various stages of forming a new nucleus and a new cell wall, so that two complete cells stand where formerly there was only one.

It has been said that the most beautiful symmetry in the world is the symmetry of the living system. And so perhaps more than any of us can now conceive, we are all part of a vast pattern, from the tiny chloroplasts in the cell to the largest living thing, the big tree. And the design found everywhere, whether in a pine needle, in a wood cell, in a crystal, in the milky way, or in the whole vast created cosmos, is perhaps proof that we belong to an ordered universe.

MEDICINE — ITS DEBT TO THE VEGETABLE KINGDOM

By JOHN C. KRANTZ, JR.

Dr. Krantz, who is Professor and Head of the Department of Pharmacology of the School of Medicine, University of Maryland, presented this paper before the Southern Shade Tree Conference, held in Baltimore, Maryland, in February, 1961.

DISEASE is the arch-enemy of man—it has harassed his activity all along the tortuous path of progress from a superstitious dweller in cliffs to an occupant of the modern skyscraper. Every human achievement has been conditioned by and limited to man's success in combating his ever-vigilant enemy, disease. Toward the end of the nineteenth century the French left thousands of tombstones in Nicaragua as a monument to their failure to build a canal and to the triumph of malaria and yellow fever. In the beginning of the twentieth century the United States built the Panama Canal, severing the spine of the continent as a miracle in engineering, but to no less degree triumphing miraculously over the devastating diseases of malaria and yellow fever.

Man has always been awed by disease. He has considered it divine punishment, the visitation of the devil, the capriciousness of nature, and more soberly the natural milestones on the journey of life. To survive he has learned that

disease must be checked and thwarted. Today, with every scientific tool available, he wages endless warfare against disease.

What is the news from the battle front? How is the campaign going? Let us examine the record. During the Roman Empire the average life expectancy at birth was twenty-one years. When William McKinley sat in the White House, the life expectancy had been increased to forty-five years. And now as John F. Kennedy assumes the task of the presidency, it has been increased to seventy-two years. For these enormous gains mankind and medicine owe a great debt of gratitude to the vegetable kingdom.

The story begins more than three centuries ago. The Countess of Chinchon was cured of malaria fever by the use of Peruvian bark *(Cinchona),* known to the South American Indians as "quina quina" bark. The bark was taken across the Atlantic Ocean to Spain. In Europe, however, it was opposed by many physicians who contended that because the drug was not mentioned in the works of Galen, its value was questionable. In 1820 the distinguished French pharmaceutical chemists, Pelletier and Caventou, succeeded in isolating from the bark the alkaloid quinine. The value of this active principle in the treatment of malaria was irrefutably established.

Malaria has played an important part in military campaigns of ancient and modern times. The vacillation of the Greeks before the walls of Troy is alleged to have been caused by malaria. The soldiers of Hannibal dropped like mists before the sun in the pestilential environs of Rome. Lee suffered from repeated attacks of recurrent malaria during the hard campaigns of the Civil War. He had contracted the disease in Baltimore, while he was supervising the building of Fort Carroll in the Patapsco River. Campaigns in southern Russia during World War I were hampered and modified by the omnipresent anopheles mosquito.

Shortly after the Versailles treaty the Germans attempted to achieve their independence of natural sources of antimalarial drugs and produced "Plasmoquin"; this scored its shining mark in the cure of malignant malaria, against which quinine is not very effective. In 1932 "Atabrine" was announced—it was the result of the synthesis and trial of twelve thousand new compounds. Had the authorities of the Third Reich kept the secret of "Atabrine," our problems in fighting World War II would have been greatly accentuated. Java produced ninety-five per cent of the world's supply of quinine. When this island fell into the hands of the Japanese shortly after Pearl Harbor, our ability to combat malaria might also have passed, had not American scientists been capable of producing "Atabrine." With it we were able to keep troops in the South Pacific malaria-infested jungles, wage a successful African campaign, and keep troops in Sicily despite the presence of the deadly anopheles. Without "Atabrine" history would have been different. And for the conquest of the ubiquitous disease, man can thank the vegetable kingdom.

Pain is another enemy of mankind. It is a tax levied on everyone for the privilege of life upon this planet. Some are taxed heavily, others lightly, but all are taxed. Man combed the earth to acquire agents that would permit him to achieve a surcease from pain. And again the vegetable kingdom responded. The opium poppy *(Papaver somniferum)* yielded morphine. This was the first alkaloid extracted from a plant. Syndenham declared, "Medicine would be a one-armed man without it." But morphine is like the finger of God, it can heal and it can smite. Addiction to its use has been one of the curses of mankind. Yet in the relief of pain, it has rendered invaluable service.

Let us now turn to the "heart of the matter," for the vegetable kingdom provided the purple foxglove *(Digitalis purpurea)* for the treatment of congestive heart failure. This is how it happened.

One of the most distinguished societies of England in the eighteenth century was the Lunar Society. Among its members were Erasmus Darwin, grandfather of the immortal Charles Darwin, James Watt, who discovered the power of steam, Joseph Priestly, who discovered oxygen and nitrous oxide, and William Withering, the "flower of English physicians." The principal of Brazenose College was seriously ill with dropsy. The standard treatments of the day had failed. The herb concoction of Mrs. Hutton of Shropshire was tried and produced dramatic results. This information reached Withering, who had the simplicity to wonder about it. He sought out Mrs. Hutton and for a few golden sovereigns secured the formula for the herb concoction of many ingredients. Carefully and experimentally he tried the activity of the various drugs on turkeys, ultimately arriving at the conclusion that it was the leaf of the purple foxglove that was responsible for the beneficial results. Those who are physicians in this audience can hear him as he said, "With this drug we can regulate the pulse at will." Little did he realize the importance of that timeless paper, published in 1785, "The Foxglove and an Account of Its Medicinal Properties." Withering, the busy clinician, Withering, the distinguished botanist, Withering, the connoisseur in mineralogy, would have been lost to posterity, and the same tomb which covers his body would have covered his fame also, if he had not had the simplicity to wonder about and the ability to question an old herb concoction. And because of the value of digitalis in congestive failure, the vegetable kingdom has made it possible for many Americans to go about doing useful work who would otherwise be on their beds of illness.

Mental illness and its treatment are major problems of society. For its solution man anxiously awaits advances in the medical and social sciences. To emphasize the vastness of this problem one needs only to state that approximately fifty per cent of the hospital beds in the United States are occupied by mentally ill patients, and that nearly two hundred thousand people annually are affected by mental illness. The cost of this affliction to the American taxpayer is approximately one and a quarter billion dollars, to say nothing of the loss of productive work, and the anguish

and emotional trauma that are entailed by the illness of the mind. Sixty per cent of these patients are released the first year, some to return later; five per cent are released after two years, but only one per cent is released thereafter. The remainder are kept under hospital care for an average period of twenty-six years. Within the past few years the vegetable kingdom has made a definitive contribution to thwart the insidious ravages of mental illness.

About a decade ago a chemist named Albert Hofmann, while he was working with some of the derivatives of the old obstetrical drug ergot *(Claviceps purpurea),* inadvertently ingested some of the dust from a derivative known as lysergic acid diethylamide or LSD_{25}. He experienced vertigo and blurring of his mental alacrity. He took a small quantity of LSD_{25} and experienced delirium, dizziness, and a display of fantastic images and rapidly changing colors. The syndrome in some respects resembles the disturbed mind of the schizophrenic patient.

It was soon discovered that a chemical substance found in the brain, called serotonin, related chemically to LSD_{25}, could terminate the schizophrenic-like symptoms produced by LSD_{25}. Related chemically to the normal brain constituent, serotonin, is the interesting Indian drug reserpine. This drug, derived from *Rauvolfia serpentina,* has been used for years in Indian medicine in the treatment of the mentally ill. It was soon discovered that reserpine used in the treatment of the psychomotor turbulence of schizophrenia achieved its action by displacing serotonin from its sites of deposit in the brain.

Reserpine was followed by chlorpromazine, which likewise acts definitely upon certain brain constituents, producing tranquil states in agitated patients. Chlorpromazine chemically is a phenothiazine derivative. The organic chemist has not been slow in producing many modifications of this drug. Among these anti-psychotic drugs are "Sparine," "Trilafon," "Pacatal," and a score of other agents which have broadened the spectrum of therapy in mental illness and have enabled the patient to receive benefit with a minimum of disagreeable side effects. Mental illness has been an enigma, and to the vegetable kingdom we owe our first definitive clue for unravelling its subtle perplexities.

Man has raised his eyes to the hills from this earthly vale of tears and exclaimed as did Jeremiah, "Is there no balm of Gilead—is there no physician there? why then is not the health of the daughter of my people recovered?" The vegetable kingdom has met the plea with quinine, digitalis, morphine, reserpine, and other drugs. We stand in awe of the vegetable kingdom with its complex chemical syntheses, as did Tennyson when he penned

> Flower in the crannied wall,
> I pluck you out of the crannies,
> I hold you here, root and all, in my hand,
> Little flower—but if I could understand
> What you are, root and all, and all in all,
> I should know what God and man is.

Just as the shade trees, which you nurture and cherish, protect man from the impartial heat of the noon-day sun, so the drugs derived from the vegetable kingdom shield him from the relentless ravages of disease.

ESSENTIAL CONSIDERATIONS FOR ROSE-OIL PRODUCTION

By Robert L. Swaine

Mr. Swaine is with the Food and Flavor Section of Arthur D. Little, Inc., Cambridge, Massachusetts.

As an industrial perfume chemist, I receive each year many letters that briefly go something like this:

"Dear Sir:
"I have just finished reading an article in a certain popular magazine that says rose oil costs $500 per pound. I have in my garden several rose bushes. Can you tell me how I can get the oil from these roses and, secondly, where can I sell this oil?"

The above letter obviously is ficticious, but if one were to substitute sweet pea or lily-of-the-valley or any of about thirty other flowers, he would have some idea of the interest people have in capitalizing on flowers for more than appearance's sake.

It is true that the concentrated scents made from flowers are costly. However, before one considers capitalizing on the odor characteristics of flowers, there are three points that must be considered. The first is the type and quantity of flowers; the second is the technical know-how; and the third is the labor cost. Going into some detail on each of these, I would give the first answer to the writer of the above letter by pointing out that the yield of floral concentrates from most flowers is exceedingly small. Technically speaking, a good yield is around one-tenth of one per cent; thus to obtain a pound of rose oil one would need a thousand pounds of rose petals. Obviously, the horticulturist who may have one dozen or even ten dozen rose bushes cannot produce the quantity of roses necessary for a commercial concentrate operation.

The next disappointment that I am forced to tell my correspondent is that even if he had a sufficient quantity of roses, it is doubtful that he has the correct variety. As roses have been bred to capitalize on their appearance, their delightful aroma has decreased. Therefore, most roses today are entirely unsuited for perfume work. The original Bulgarian rose, *Rosa damascena,* as well as *Rosa centifolia,* the commercial rose of France, are the two main kinds of roses that are grown for their aroma. In appearance, these two roses would never win any honors in a rose show. Now that I have thoroughly disappointed my letter-writer by saying that he does not have enough roses and that, even if he did, they are not the correct variety, I must further disappoint him by pointing out the commercial procedures necessary to obtain the rose fragrance from the rose and to put it in some commercial form useful to the perfumer.

The origin of rose oil, or otto of rose, as it is sometimes called, is not entirely clear. Some historians say that it was first produced in China. The story goes that a scum of rose oil was found on the pool of one of the emperors of China after he had had it filled with rose water. Others say the first production of rose oil occurred in Bulgaria where it was distilled during the early part of the Middle Ages.

Actually, Bulgaria is the country that has, up until the last few years, produced most of the rose oil of commerce. The phrase "otto of rose" is almost synonymous with Bulgarian rose oil.

Today, considerable quantities of oil of rose are also produced in France and Morocco, and smaller quantities in several other countries. By understanding how oil from the rose is obtained commercially, the amateur can easily see the inadvisability of attempting its manufacture.

There are three methods of obtaining oil from the rose; distillation, one of the oldest, is still used today; enfleurage, although not used as much now, is historically of great importance; and solvent extraction, the one most often used.

The traditional distillation in Bulgaria consisted of placing freshly picked rose petals in a large kettle with water. This rose-petal–water mixture was boiled by direct heat, and the mixture of rose-oil vapor and steam was carried through a condenser where it was condensed into rose-oil droplets in water. This mixture was set aside, and the process was repeated with a fresh batch of roses. After several of these distillations had been completed, the mixture of rose-oil droplets and water was again distilled in the same manner; and this time the rose oil was collected as it floated to the surface of the collecting vessel. This rose oil, separated from its surrounding water, was known as otto of rose. Improvements have been made so that now instead of directly heating the water–rose-petal mixture, steam is introduced and the steam carries over the oil droplets to a collecting vessel, from which the oil is separated. It is important in this, as well as in the other methods, that the roses used be freshly picked and that they not be allowed to dry out or lose their delicate aroma.

The second method is that of enfleurage, which can probably best be described as the mechanism by which butter picks up fish odor when the two are placed in the same refrigerator. Enfleurage is a French process. Freshly picked flower petals are placed in contact with a bland fat. The petals are left in contact with the fat for about twenty-four hours. At the end of this time, the old petals are replaced by fresh ones. This may be repeated many times, and it is not uncommon to use up to thirty-six different changes of rose petals. The rose oil is separated from the fat by extraction with alcohol. The alcohol–rose-oil mixture is then further purified until a product called an absolute containing only rose oil is obtained. This resulting product, manufactured without heat, is of the highest quality of odor and somewhat different in type from the rose otto produced by the application of heat either directly or in the form of steam.

The third method and one that is becoming most popular is that of solvent extraction. In this method the rose petals are mixed directly in a container to which a suitable solvent, such as petroleum ether, benzene, or hexane, is added. This material selectively dissolves the rose oil together with certain waxes from the rose petals. Then the solvent is carefully removed. Here again little, if any, heat is involved so that the resulting concentrate is of excellent odor quality. This concentrate is further purified so that the waxes are removed, and a pure absolute of rose oil is left.

To efficiently operate the distillation, the enfleurage, or the solvent extraction process, hundreds of tons of rose petals must be available. The technical know-how is vitally important, otherwise the resultant product will be of inferior quality. It would be rather foolhardy to use these methods, and hope to obtain sufficient quantities of a quality rose oil that could be offered to the perfume trade, without sufficient technical background and a sufficiently large quantity of roses.

A third point must also be considered, that is, the available labor supply. There exists in Europe, Africa, and Asia a labor force whose hours are long and whose pay is relatively small. Perfume oil producers have relied upon this labor market particularly for picking flowers from the fields. It is not uncommon in these countries to see small children and elderly people working from before sun-up, when the roses are at their prime, until late in the afternoon. Here in the United States, such labor supply is not available. Hence, the cost of using skilled labor to pick roses becomes prohibitive.

Summarizing a perfume chemist's thoughts to those who have enjoyed the appearance of a rose and have considered the advisability of extracting the rose aroma for profit, I must caution that: 1) the type and quantity of roses you have are probably not correct; 2) the technical know-how certainly must be mastered; and 3) there is a distinct shortage of suitable labor, should you be able to conquer the first obstacles.

RESEARCH ON BLACK SPOT OF ROSES

By E. W. Lyle

Dr. Lyle is Plant Pathologist of the Texas Rose Research Foundation, Inc., Tyler, Texas.

Black spot is listed frequently as the most damaging disease of roses. Its primary harm is defoliation with yellowing and loss of leaves during the growing season, and this results in stunting of the bushes, fewer blooms of smaller size, and less color and fragrance. The bushes become subject to dieback of the canes and to winter-killing, with both conditions being associated with decrease in vitality proportionate to the amount of and the length of the period of defoliation. The cause of black spot is a fungus *(Diplocarpon rosae)* that occurs only on the rose and no other plant. The disease has been known for more than a century and develops on wild as well as cultivated forms of roses in all except the most arid regions in which roses may be found.

APPEARANCE

Black spot is recognized mainly by the unsightly spots or blotches on the rose foliage; however, the disease can infect stems, canes, and other new growth. The importance of cane lesions of black spot was described as early as 1918 by N. L. Alcock in England, and from such spots it is quite likely that most of the new infections originate early in the season. The black color of the infections is from decomposed rose tissue rather than from the fungus, since the fungus threads (mycelia) and spores are nearly colorless. The spots generally have fringed or irregular borders

and increase in size as the fungus spreads through the host tissue. Development is slow in cool weather and faster in warm; subsequent defoliation likewise is influenced by the temperature. Infections do not become apparent until from five days to three weeks or longer after spore germination and initial entry into a rose leaf, depending again on temperature, humidity, and conditions of plant growth.

SPREAD

Black spot is distributed by the fungus spores, which are loosened by rain or water from the spots in which they form. The spores are carried usually by wind-blown rain or spattering to other leaves or places to begin new infections. Moist conditions favor the germination of the spores; investigations and study have revealed that infection occurs only after the spores have been in water or an atmosphere of high humidity for a period of six hours or more. Further examination has disclosed that the first spread in the spring is probably from spots carried over winter in the canes or from attached leaves that remain on the branches rather than from fallen leaves on the ground. Certainly there is no proof that the fungus overwinters in the soil itself. This is substantiated by data published in *Phytopathology* in 1958 by the United States Department of Agriculture at Beltsville, Maryland, in which close pruning of the canes during the winter nearly eliminated early black spot infection.

L. M. Massey, Cynthia Westcott, Alice Aronescu, E. W. Lyle, and others have reported many of the experiments and studies that deal with the cause and development of black spot. Significant is the fact that both the upper and lower sides of the leaves may be infected and that the spores tend to be held together where formed until freed by water. This could account for better control by the use of spray rather than dust fungicides.

CONTROL

Certain of the new spray fungicides have given remarkable action against black spot so that nearly complete control has been effected. This has been accomplished even when the treatments were not started until the disease was widespread. The experiments in 1957 reported by the Texas Rose Research Foundations, Inc., showed the best sprays reduced black spot to five per cent or less by September 24, when the dust fungicide considered best had thirty per cent and the untreated checks had sixty per cent infection. Twelve applications of the fungicides were made from June 12 through September 25. Seven thousand bushes of 'Floradora' were in the test.

As reported in the *American Nurseryman,* April 15, 1958, tests with spraying to control black spot have proved the importance of an adequate volume for each application. A rate of two hundred and forty gallons per acre for each application was nearly twice as good as one hundred and twenty gallons.

The 1959 trials, as reported in the *American Nurseryman,* November 15, 1960, indicated that two hundred and fifty gallons per acre of half the normal concentration of maneb were better than one hundred and fifty gallons per acre of the normal concentration of one and a half pounds per one hundred gallons.

The best results so far in Texas have come from five spray fungicides: "Dithane M-22," "Phaltan," "Manzate," "Cyprex," and captan. Both "Dithan M-22" and "Manzate" are maneb compounds. All have given good results when properly used, and each has an advantage over the rest. Less

Black spot on rose leaves. The size of the spots is indicative of how long the infection has existed; spots grow about one quarter of an inch in diameter for each five or six weeks.

Spores or conidia of the fungus that causes black spot, dispersed in water and stained to be photographed. Two thousand spores end to end would be about an inch in length.

beneficial have been "Fermate," "Zerlate," "Glyodine," "Dyrene," and "Thylate," to name some of the other sprays that are available commercially. The addition of a spreader-sticker such as "Triton B-1956" or "Plyac" has appeared to improve the action of the maneb sprays but not the latest formulation of "Phaltan."

Caution should be given about using concentrations that are too strong or the repeated use of certain chemicals that gradually become damaging through accumulation. "Cyprex" was found harmful after the second treatment at the rate of two pounds per one hundred gallons; yet it was quite safe and effective at a quarter of a pound per one hundred gallons, and equally so at a one-third-pound rate through eight applications. Captan spray was found safe through twelve applications at rates up to six pounds per one hundred gallons; it did give good control of black spot at that concentration, but it left an unsightly deposit of chemical on the foliage.

Regular weekly spraying has given good control of black spot in both field and garden treatment. For several seasons here the system has been to begin with weekly applications and then to reduce the frequency when the disease is absent or the weather dry. Usually the tests have been concluded with treatments every other week; in this manner the residual effect of the best fungicides was proved.

Nearly complete control of black spot can be obtained with bushes in close proximity to those with the disease. The distance of fifty-two inches from one row to the next can be sufficient to effect control in one plot while permitting it to occur in another.

While the volume of spray each time has been mentioned previously as important in the control of black spot, the pressure in spraying has less value except to speed the treatment. Sprayers may vary in pressure as much as from two hundred pounds to six hundred pounds and yet have comparable results, provided the same volume of spray material is applied. In the field trials cited, tractor equipment was employed in which the nozzles were set uniformly in height and direction, and the pressure was the same for all the plot treatments in each experiment. Practice has shown that excellent control may be obtained if the spray is directed upward from all the nozzles; thus, if sufficient coverage of the lower side of the foliage is obtained, enough spray gets to the upper side to accomplish black-spot control there also.

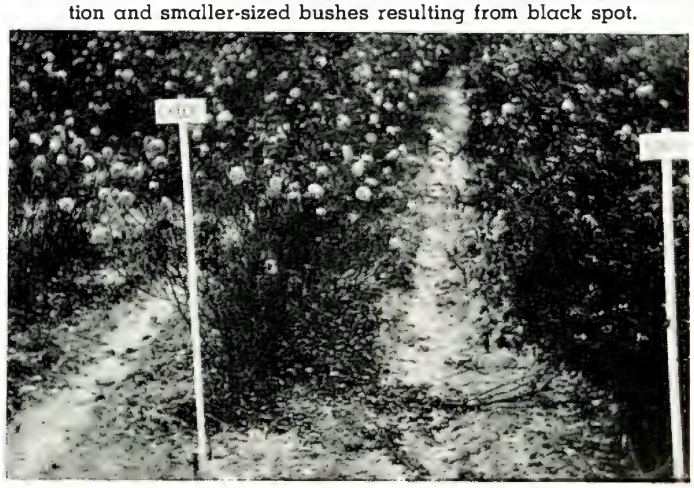
BENEFITS FROM CONTROL OF BLACK SPOT

Leaf counts and determination of the percentage of infection can show the degree of control of black spot. However, this represents the appearance for one particular date. Of greater value is the weight of the bush at the end of the season, because it reflects the accumulative effect of the series of applications and may show a growth response over a full season. At the same time it is not the size of the bush that is important as much as the factors of quality that would be included with an increase in size because of disease control. In one test the sprayed bushes averaged forty-two per cent more weight because of black-spot control than the unsprayed checks. Measurements of starch content in the rose canes are now used to indicate whether or not the bushes have been kept healthy and are of good maturity for harvesting and storage.

The satisfactory maturity of canes that has been obtained through the use of the new fungicides permits them to be kept in storage as budwood for as long as two years, when they are still of good vitality and condition for propagation. Hard canes and deep purple or green coloring of the bark are indications of disease control and of bushes that will survive transplanting and periods of storage. On the other hand, bushes that are devitalized by black spot or by some other disease or insect trouble usually exhibit light green bark and often have dieback in the branches.

Mention has been made in other publications that control of black spot one season may delay the incidence the next year. This benefit is in addition to those which are usually cited as to the greater number of blooms and the greater length of stems. The control of disease leads also to larger flowers with more color and fragrance. Over twenty years ago, in the annual report of the Texas Agricultural Experiment Station, the statement was made that defoliation seemed the most important factor to cause fad-

The rose 'Floradora' in a field test. Right. Control of black spot with fifteen applications of a maneb spray between June 12 and October 23, 1957. Left. No fungicide after June 1 showing defoliation and smaller-sized bushes resulting from black spot.



ing in rose blooms. Such observations must have been made many generations ago, but it has remained for the past few years of research and the development of fungicides to prevent black spot to the degree that is now possible. Fields and gardens can have roses nearly free from black spot year after year, without depending on weather to give a natural control one year in a decade as was formerly seen in this location as well as in many other places in the United States, where black-spot disease is a factor in rose-growing.

RUTGERS' RESEARCH ON EARTH'S MOST NUMEROUS CREATURES — THE NEMATODES

NEMATODES ARE WORMS, primitive even among primitive creatures, and are among the most numerous on earth. They may well prove to be one of man's worst economic enemies. Conservative estimates put the annual damage from nematodes at seven hundred and fifty million dollars, and a billion may be closer to a fair guess. Scientists at Rutgers University, in New Brunswick, New Jersey, estimated in 1959 that the nematode damage to agricultural crops in New Jersey alone was in excess of fifteen million dollars annually.

Nematodes are omnipresent on the face of the globe and beneath its seas. Solid rock will not support a nematode; but if a single lichen grows in a crack in a rock wall, there will likely be nematodes within the growth or in the meager grains of soil that support it.

Nematodes have been thawed from the Antarctic ice after years in nature's deep freeze. They have been found in Sahara's sands, at the bottom of extremely deep alpine lakes, and universally in the soil. A teaspoonful of typical New Jersey soil may harbor more than one thousand of these ubiquitous worms.

Since nematodes are aquatic animals, the sea bottoms of the world hold them in uncounted numbers. Scientists believe that seventy-five per cent of all the nematodes are marine forms; but so new is the science of nematology that there are only a few competent marine nematologists today, and their systematic study of the sea-bottom population has hardly begun.

Some scholars hold that Biblical reference to the "plague of fiery serpents" had its origin in a nematode which burrows deeply into the muscles of the leg. Medical men today know nematodes as the pinworm, the hookworm, and the *Trichinella* that causes the dread disease trichinosis. No fewer than forty-seven species are parasites of man.

There is reason to believe that ninety per cent of all humans harbor, at one time or another, some kind of nematodes (including the harmless, invisible ones that live happily in the filter beds of water-treatment plants and often come through the pipes into our homes).

Veterinarians have even more concern, since many more nematodes are parasitic on animals than on humans. Those which attack animals can typically grow to a foot or more in length (not to mention the specimen measuring almost thirty feet that was once recovered from the placenta of the blue whale).

The role of soil nematodes in plant damage was first reported in 1876 through the study of the plant disease known as root-knot; it was thereafter often dubbed the nematode disease. However, the significance of the teeming population of nematodes in the soil was not realized for many years. Root-knot disease is now known to affect more than two thousand different plant hosts, and no fewer than sixteen species of nematodes can contribute to the damage.

Scarcely fifteen years ago, scientists of the United States Department of Agriculture were experimenting with the fumigation of the soil to check populations of nematodes that live within the roots of plants. (These are the endoparasites.) In the course of their work, they noted that sharp and unexpected decreases in plant growth resulted in fumigated areas where the known parasites were not present. The reason was soon found; other varieties of nematodes in the soil had been attacking the plant roots from the outside. (These are the ectoparasites.) This dis-

(Continued on page 177)

Dr. William R. Jenkins examines pots of young yews in a greenhouse at Rutgers University. These yews will be tested for their susceptibility to various nematodes. Research will also be undertaken to determine the effectiveness of different nematocides.

AN ENGLISHMAN WRITES OF THE GROWING INTEREST IN CACTUS AND SUCCULENT PLANTS IN EUROPE

By Sir Oliver Leese

Sir Oliver became interested in cacti and succulents when he commanded thirty corps in the North African campaign in World War II under Field Marshall Montgomery. The collection he started as a hobby has grown into a profitable nursery—Worfield Gardens, Bridgnorth, Shropshire—in which Sir Oliver and Lady Leese are partners. They visited The New York Botanical Garden in February, 1960.

Cereus peruvianus

WHAT MAKES THE WEEDS of one country become precious and valued plants in another part of the world? In America you have cacti, prickly, ugly, fierce, looked upon by many as common and uninteresting, sometimes even as a menace, and yet a few thousand miles away these very plants are treasured possessions of hundreds of collectors, who rear and water them with loving care. The cacti are not the only plants of this category, for it includes most of those which, for want of a better name, have become known as succulents. They are the camels of the plant world, and they exist in every country where water only comes at infrequent intervals—sometimes up the slopes of rocky mountains, sometimes along the edges of a desert.

There are over nine thousand different kinds of succulent plants in the world. These include some sixteen hundred natural species of cacti and many epiphyllum hybrids. The other succulents are scattered through many different plant families. The largest group comprises more than two thousand species of *Mesembryanthemum* in South Africa, embracing the shrubby ones, and the tiny lithops and other mimicry living-stone plants.

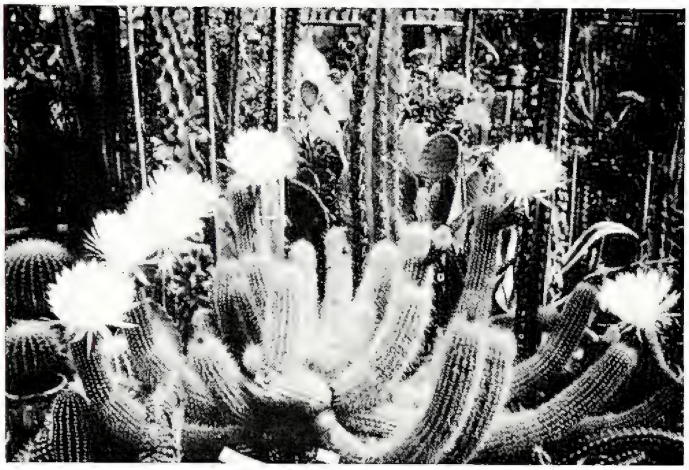
They are fantastic plants and especially so for someone who comes from a cold, damp climate such as we have in England. Before the second World War the average Englishman did not travel far afield from Europe; and the excitement and thrill, such as my wife and I have recently had in America, Mexico, and Africa, in seeing something of this succulent world in the wild, was confined to that now obsolete species "The mad dog Englishmen," who through many decades challenged the rays of the midday sun in well nigh every part of the globe. But today all this is changed; with the restrictions off the currency regulations and with the increased ease and efficiency of air travel, the world is open to the British tourist. In Europe, especially, travel charges have now come within the means of many British families who before the war could not afford the luxury of going abroad. Many of the countries now open to British tourists can be reached in a few hours from London and include seaside resorts on the Mediterranean and Adriatic coasts, where the warm climates are well suited to the growth of succulent plants.

Mesembryanthemum 'Tresco Apricot'.

The Mediterranean basin is the region in Europe where cacti are grown out-of-doors most successfully. Here one finds the prickly pears (the opuntias) with their flat spiny pads, the agaves with their long pointed leaves—either bluish green or variegated with streaks of gold and yellow—and an attractive array of tall, deep green euphorbias. The prickly pears and the agaves have flourished in these parts for so long that the local inhabitants consider them indigenous. But this is very far from true, as they originally came from America, possibly in the ballast of one of Columbus' sailing ships. They are to be seen everywhere along the Mediterranean coasts of France, Spain, and Italy, for they grow well in the balmy sunshine and especially so in the anti-frost pockets that are to be found at intervals. In these coastal regions there are occasionally very cold winters, as occurred in 1958 when the opuntias were laid low by a long continuous frost. The old plants were killed; nothing was left standing except gaunt skeletons. However, when we went to Spain in the autumn, we noticed the little pads which had dropped to the ground; and so great was the urge for life that large numbers of new green plants had rooted and were starting to grow around the skeletons.

Opuntias are sometimes used for hedges, especially in Spain, where they are to be found on the estates where bulls are bred for the bull fights. They are a tough proposition to encounter, equally effective as and much more picturesque than barbed wire. Agaves, too, can often be seen, especially from the train, as they are used on embankments to stop erosion. In many places one will find the shrubby mesembryanthemums—usually purple, gold, or scarlet—growing along the sea coast just as they do in California where they have been introduced.

There is a brisk trade throughout the year in the coastal town for small cactus and succulent plants in pots—sometimes arranged like dolls' gardens with miniature colonnades



Trichocereus in bloom in a show exhibit.

or pergolas. These are well set in the gay little tourists' shops and in the flower markets, where the somber colors of the cactus plants are a foil to the vivid colors of the flowers that grow in the nurseries along the coastal strip.

A few succulent plants are also to be found in the nurseries in the south of France and in Italy, usually situated in anti-frost pockets, where a great deal of the work can take place out-of-doors. The gardens in these nurseries are often very attractive with a fine array of handsome plants, which are usually used for seed, but sometimes are sent to the cities of Europe for display purposes in the big horticultural shows. On two occasions since the war some of the finest Italian show plants, including magnificent specimens of *Cephalocereus, Euphorbia,* and *Echinocactus grusonii* have been sent to the Chelsea Flower Show in London. There they have attracted the same attention and admiration that they do in the vast continental Fleuralies in Paris and in Ghent.

Of all the succulent gardens in the south of France, that of the Jardin Exotique at Monte Carlo still ranks foremost. The plants occupy several acres along the cliffside, looking down on the azure sea and the lovely white outline of Monte Carlo. There are some beautiful tall plants; and in particular I remember the archways and tunnels formed by the giant specimens of *Cereus* under which a visitor winds his way from bridge to bridge as he saunters through the gardens.

There are also several cactus nurseries in other parts of France, where the plants are grown in heated greenhouses as they are in England and Germany. Some of these supply the Quais and the flower markets in Paris.

The Quai de la Megisserie, on the right bank of the Seine, is the hub of the horticultural world in Paris, including the house of Vilmorin. Along the river's edge are the little stalls that sell pictures, prints, and books and opposite are the caged birds, the fish, and the cacti. On the left bank of the river are the open flower stalls—a riot of glorious colors—with a few well-filled and covered stands that sell succulents and green plants.

In Spain, too, there are a few cacti, and an interesting outdoor garden at the Pinya de Rosa, near Blanes on the Costa Brava. Here Señor de Ribera, a successful industrialist, who is also a keen botanist, has created a garden to study various types of succulent plants. He works in very close collaboration with other European experts on succulent plants and has done a great deal to encourage research especially in *Opuntia, Agave, Aloë,* and *Mesembryanthemum* in which he specializes.

But it is not only in countries with seaboards on the Mediterranean where an Englishman finds cacti in Europe. There is an extremely interesting collection in one of the city corporation's greenhouses in Zürich, Switzerland, with as good a selection of small pincushion and barrel cacti as one will find anywhere. Germany, Holland, and Belgium, too, are countries where nurserymen grow succulent plants. Germany has given us many expert horticulturists and botanists, such as Curt Backeberg, Werderman, and Hermann Jacobsen, who have contributed greatly to the scientific work on this subject; and probably the best-known cactus seed firm in the world is Winter's establishment near Frankfurt. In Holland and Belgium several firms grow succulent plants, mostly for the market and for export. The soil along the canals forms excellent compost, and the plants grow well. A lot of grafting is done in Holland in order to provide large plants in as short a time as possible for the pot-plant trade; and one sees a cactus or succulent plant in most of the large and airy windows that one passes.

Sometimes the small pot plants for market are packed in wooden trays—with the pots plunged in the black compost—so that the soft blues and grays of the succulents contrast with the gay red and yellow flowers on small rebutias and notocacti. These boxes are piled on the open barges that sail down to the markets on the canals and are tended by Dutch boys wearing black corduroy trousers and narrow peaked caps. The markets, too, are fascinating. The barges go into the auction room, and the plants are sold in their boxes to the buyers. The buyers, sitting on raised seats, press the electric buttons in front of them and thus register their bids by means of the lights that appear on a board behind the barges. It is a most picturesque sight and well worth a visit.

In England the great horticultural event of the year is the Chelsea Flower Show, organized by the Royal Horticultural Society. During four days in May everyone who is a gardener or a plantsman likes to visit the show to see new plants or to enjoy again his old favorites. The exhibits cover a wide and varied range of plants of high quality. It is the shop window of a great gardening nation. For

An exhibit of cacti and succulents at the Shrewsbury Show.

the succulent lover, like every other earnest connoisseur of his own subject, there are stands—small and large—of cacti and succulents. Sometimes there are visiting enthusiasts, such as the Italian growers from Bordighera and San Remo with their huge golden barrels and white-haired cephalocerei, grown well and vigorously in the Riviera sun; or the German growers with arrangements of small cacti in squares and lines, much as they might have formed up their troops at Minden and Waterloo. Sometimes Africa displays a selection of succulents, including some of the weird, yet lovely stapelias from its arid regions. Several faithful British cactus nurseries always set up stalwart stands. Here the cerei, which very often flower at this moment, are quite as tall as any that come from the continent. A mass of smaller plants are usually in flower, from the tiny scarlet and yellow rebutias and the pink and mauve mammillarias to the many epiphyllums whose deep purple and red, salmon and pink are as vivid as any flower in the show. Among the other succulents, *Euphorbia splendens* should be showing its scarlet flowers, and the little grey-leaved *Kalanchoë pumila* from Kenya its graceful pink ones.

This is also a lovely time of the year in a succulent nursery in England. The echeverias have been in flower for nearly two months—with *Echeveria* 'Worfield Wonder' a riot of gold and scarlet flowers on its low, even slender stems which never sprawl or grow lanky and spindly. There are flowers on many of the big show plants—huge white scented ones on *Trichocereus spachianus* and white ones with a pink fringe on *Cereus peruvianus,* some of which at Worfield Gardens are over twelve feet high. There is a *Selenicereus grandiflorus* which is creeping all over the house, along the pillars and the girders, and is a sea of round white flowers. A fine big plant of *Trichocereus strigosus,* with an array of great, strong, golden limbs, bears lovely white blooms. These all look very effective in the big show house against a painted background of Saguaro-

Another show collection of cacti and succulents.

land in Arizona, with the selling benches in front filled with small plants, many of which are also in flower.

In England several cactus nurseries can put on displays of large plants, and sometimes members of one of the branches of the National Cactus Society get together to arrange a most impressive showing of fine plants. Worfield Gardens sometimes puts up large exhibits at the Chelsea, Shrewsbury, and Southport Shows, which are considered three of the largest and most important; and one year we laid out an exhibit, the design of

The sales house at Worfield Gardens.

Potting up plants from Mexico at Worfield Gardens.

which was based on Mrs. Whitney's lovely succulent garden at Rancho Santa Fe in California.

During the summer Worfield Gardens are open on several Sundays, and on one weekend over three thousand cactus enthusiasts visit us from all over England. We set up dioramas with painted backgrounds, in which we show the smaller plants growing in their native surroundings, and we plant many of our show plants in a long raised bed, so that our guests may have tea on the lawn amongst the cacti. At intervals we give short performances of the colored slides that we have taken in Mexico, Arizona, and Africa. Horticultural and cactus experts are present, ready to give advice and assistance, and it has become a great assembly of cactus enthusiasts who swap stories and pass on their knowledge to beginners and to children, who are often some of the keenest collectors.

Sometimes there is a large succulent garden at the big exhibitions at Olympia and Earls Court; and in this way it is possible for collectors in many parts of England to see fine displays of succulent plants. These are, of course, all indoors, except for those gardens that are temporarily planted out in the open in the summer, but there is one place in the British Isles that has a large display of succulent plants out-of-doors all the year round. This is at Tresco Abbey in the Scilly Isles. The garden here consists of several acres and contains mostly succulents. We were there in the spring when the whole place was a blaze of color from scarlet, purple, pink, and golden mesembryanthemums, with an occasional aloë bearing aloft its tall spike of gold and red flowers. The cottage gardens, too, were very gay with mesembryanthemums growing on the stone walls all over the island.

Maybe some of my readers are wondering why all these people in Europe like these weird cactus plants, which many look upon as commonplace, dull, and even ugly. The answer, I suggest, lies partly in their fantastic and intriguing shapes, partly in their wonderful flowers which suddenly emerge from their curious bodies, and partly in the fact that they will grow well in private houses and greenhouses under conditions that other plants might never survive. They form, too, an enthralling hobby for people of all ages, from young children to those who have retired.

Some of these collectors have a great urge to travel, in order to see these plants growing in their natural habitats in the Americas and in Africa, and many of them will, I hope, go to the United States. When they do arrive in your country, I know that they will never be disappointed, now that so many of the most spectacular cactus lands are protected by your far-flung system of National Parks and National Monuments.

INTERNATIONAL FRIENDSHIP GROVE AT THE UNIVERSITY OF WASHINGTON

By Joseph A. Witt

Mr. Witt is Assistant Director of the University of Washington Arboretum, Seattle, Washington.

FRIENDSHIP groves are certainly not new, but in planting and dedication the International Friendship Grove on the University of Washington campus is perhaps unique. It was planned and planted as part of the Fifth World Forestry Congress held in Seattle last summer, a congress attended by foresters from some sixty-five nations, as a living memorial to the fact that nations can meet and discuss common problems in friendship.

It is difficult to say who first thought of planting such a grove, but the idea apparently arose in several minds simultaneously, and a committee of Forest Service, University, State, and commercial forestry representatives was appointed to work out details with Dr. Carl Ostrom, U.S.F.S., as chairman. We at the University of Washington Arboretum were privileged to be included and were assigned the task of helping to gather the trees, to hold them until the planting ceremonies, and to oversee actual planting.

The site chosen for the grove was on Campus Parkway, one of the western approaches to the University, an area of about three-fourths of an acre in the narrow dividing strip between the roadways. The south side is protected by large dormitories, the north by apartments, but at times a brisk wind blows directly down the street. Essentially flat at the eastern end, it becomes a steep north-facing bank at the west end—in all, a most difficult terrain to landscape with trees. The plans drawn by Lawrence Halprin and Associates, of San Francisco, envision the planting as a series of small connected groups composed of several large species interplanted with smaller ones. As the University expands, this section will become part of the campus and should form a beautiful and inspiring entrance.

We attempted to choose a tree typical of each country attending the Congress, within the limits of available trees and the climatic restrictions of Seattle. Fortunately, the Arboretum had a large stock of young trees in its nursery, many of them raised from seed obtained from the country they were to represent; and many others—especially northwestern natives—were offered by the Forest Service, Washington State Division of Natural Resources, Oregon State College, and the Greeley Forest Nursery. There was no hope of using native species of the tropical nations, since even Seattle's relatively mild climate cannot be expected to support anything more tender than *Azara microphylla* or *Nothofagus fusca.* For these countries we used trees native to the Pacific states, with a twofold purpose in mind: first, to insure that the species would thrive; and second, to have a collection of native trees closely assembled to-

The east section, looking toward the campus, of the International Friendship Grove at the University of Washington. In the right center *Pseudotsuga menziesii,* representing the United States; on the left, *Acer pseudoplatanus* representing France.

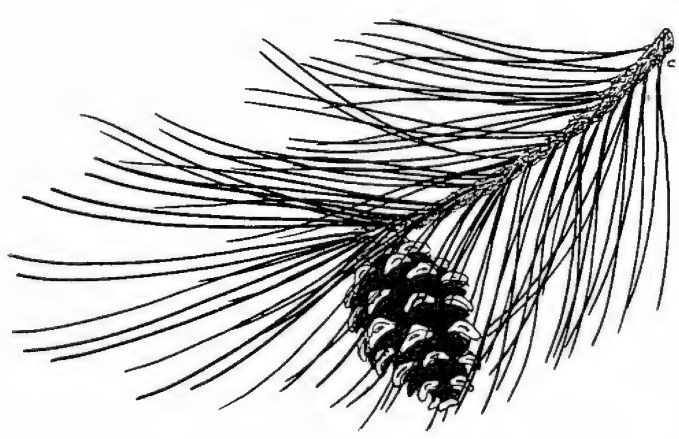
gether so students and visitors might easily find them. Unfortunately, such is not the case in the Arboretum, where one must walk nearly a mile to see these same trees.

As the day scheduled for the planting ceremony drew closer, more and more problems arose. Certain countries that were not expected sent delegations, and others sent regrets. Each tree chosen had to be passed by a protocol officer in order that no country be offended. Many times we made three or more choices before finding the right tree. Generally speaking, the trees were between three and six feet tall, and we tried to keep within these limits so no one tree would obviously overtop its neighbor. To illustrate these difficulties: *Fraxinus excelsior,* the European ash, was to represent the U.S.S.R., with *Larix sibirica,* the Siberian larch, as second choice. We were unable to locate the European ash, and the only Siberian larch was too small—less than three feet tall. Next we thought of *Betula middendorffii,* a Siberian birch available from our nursery. One was dug, but on closer examination it proved to be another and unsuitable species. We then picked out a nice plant of *Elaeagnus angustifolia,* Russian olive, but this was vetoed by the protocol people who feared that the local newspapers would make a play on use of an "olive" with its peace connotations at a time when relations between the U. S. and the U.S.S.R. were more strained than usual. In desperation we looked again at the Siberian larch; it seemed to have assumed additional stature during the interim and was deemed acceptable.

On September 3, 1960, foresters from sixty-five countries —in most cases the chief of each delegation, in picturesque uniform and accompanied by the flag of his nation—paraded down Campus Parkway. They took station before the trees, and as the name of a particular country was called, the representative planted the tree selected for his country. This most impressive and colorful ceremony made all the efforts of gathering the trees worth while.

Nation	*Common Name*	*Scientific Name*
Argentina	Roble southern beech	*Nothofagus obliqua*
Australia	alpine-ash	*Eucalyptus gigantea*
Austria	Austrian pine	*Pinus nigra*
Belgium	Norway maple	*Acer platanoides*
Brazil	Johnston eucalyptus	*Eucalyptus johnstonii*
Bulgaria	Tatarian maple	*Acer tataricum*
Burma	Oriental arborvitae	*Thuja orientalis*
Cameroun	Hinds walnut	*Juglans hindsii*
Canada	sugar maple	*Acer saccharum*
Chile	Dombey southern beech	*Nothofagus dombeyi*
China	China fir	*Cunninghamia lanceolata*
Colombia	Noble fir	*Abies procera (nobilis)*
Czechoslovakia	European mountain-ash	*Sorbus aucuparia*
Denmark	northern red oak	*Quercus borealis (rubra)*
Finland	European white birch	*Betula pendula (verrucosa)*
France	sycamore maple	*Acer pseudoplatanus*
Gabon	basket oak	*Quercus prinus*
Germany	European beech	*Fagus sylvatica*
Ghana	bigleaf maple	*Acer macrophyllum*
Greece	European hop-hornbeam	*Ostrya carpinifolia*
Guatemala	white pine	*Pinus strobus*
Haiti	sweet gum	*Liquidambar styraciflua*
Honduras	sugar pine	*Pinus lambertiana*
Hungary	European hackberry	*Celtis australis*
Iceland	Sitka alder	*Alnus sinuata*
India	Himalaya or Deodar cedar	*Cedrus deodara*
Indonesia	Golden chinquapin	*Castanopsis chrysophylla*
Iran	flowering ash	*Fraxinus ornus*
Ireland	white beam-tree	*Sorbus aria*
Israel	Oriental hornbeam	*Carpinus orientalis*
Italy	Montpelier maple	*Acer monspessulanum*
Ivory Coast	alpine fir	*Abies lasiocarpa*
Japan	Japanese red pine	*Pinus densiflora*
Jordan	Lindley cypress	*Cupressus lindleyi*
Korea	Korean pine	*Pinus koraiensis*
Lebanon	cedar of Lebanon	*Cedrus libani*
Liberia	red spruce	*Picea rubens*
Malagasy	Lodgepole pine	*Pinus contorta*
Malaya	paper-mulberry	*Broussonetia papyrifera*
Mexico	Patula pine	*Pinus patula*
Nepal	Smith spruce	*Picea smithiana*
Netherlands	little-leaf linden	*Tilia cordata*
New Zealand	red southern beech	*Nothofagus fusca*
Norway	Norway spruce	*Picea abies*
Pakistan	Himalaya horse-chestnut	*Aesculus indica*
Peru	boxleaf azara	*Azara microphylla*
Philippines	western red-cedar	*Thuja plicata*
Poland	Polish larch	*Larix polonica*
Portugal	Portugese laurel-cherry	*Prunus lusitanica*
Rumania	Macedonian pine	*Pinus peuce*
Spain	cork oak	*Quercus suber*
Sudan	Port Orford cedar	*Chamaecyparis lawsoniana*
Sweden	Scots pine	*Pinus sylvestris*
Switzerland	golden-chain tree	*Laburnum alpinum*
Thailand	Pacific madrone	*Arbutus menziesii*
Tunisia	Algerian fir	*Abies numidica*
Turkey	Turkey oak	*Quercus cerris*
Union of South Africa	western larch	*Larix occidentalis*
Union of Soviet Socialist Republics	Siberian larch	*Larix sibirica*
United Kingdom	English oak	*Quercus robur*
United States	Douglas-fir	*Psuedotsuga menziesii*
Uruguay	Englemann spruce	*Picea engelmannii*
Venezuela	eastern hemlock	*Tsuga canadensis*
Viet-Nam	Saghalin spruce	*Picea glehnii*
Yugoslavia	Serbian spruce	*Picea omorika*

The International Friendship Grove is nearly a year old, and most of the trees have put on a respectable growth. Each is marked with a small plaque identifying the tree and the country it represents. At the east end of the grove there are two flagpoles on which the flag of the United States flies side-by-side with the blue and white banner of the United Nations. And we sincerely hope that the example of these sixty-five trees growing together in peace will encourage the sixty-five nations they represent to do likewise.



The Instituto Botánico as seen from the palmetum; the windows are in the herbarium.
Insert. A water lily-pool in the patio adjacent to the herbarium.

THE BOTANICAL INSTITUTE AND BOTANICAL GARDEN OF CARACAS, VENEZUELA

By JULIAN A. STEYERMARK

Dr. Steyermark, of the Instituto Botánico, and specialist on *Rubiaceae,* was Curator of the Herbarium at the Chicago Natural History Museum from 1950 to 1958 and connected with that institution from 1937. He has written for scientific and popular publications, is author of *Spring Flora of Missouri* and co-author with Paul C. Standley of *Flora of Guatemala,* which has so far been published in eight volumes. He published four volumes on *Contributions to the Flora of Venezuela* as the result of botanical explorations in that country in 1943-45. Since 1944 he has explored the sandstone tablelands and was co-leader of the joint expedition of the Chicago National History Museum and The New York Botanical Garden that reached the summit of Chimantá Massif, the largest table mountain in Venezuela.

Dr. Steyermark is an honorary research associate of the Missouri Botanical Garden, a botanical consultant to Eli Lilly Co., an honorary member of Sociedad Venezolana de Ciencias Naturales and of Instituto Ecuatoriano de Ciencias Naturales. He has been an active leader in conservation through the Missouri and Illinois Nature Conservancy.

In recognition of his work on the flora of Guatemala, Guatemala is bestowing on Dr. Steyermark the Medal of the Order of Quetzal. It will be presented on his return to Venezuela.

NESTLED IN A PLEASANT MOUNTAIN VALLEY, facing the city proper and within its boundaries but hemmed in by the hills, lie the *Instituto Botánico* and *Jardín Botánico* of Caracas, capital of Venezuela.

For some time there has been a close relationship between this South American botanical institute and The New York Botanical Garden. Since 1944, Dr. Bassett Maguire, Head Curator and Coordinator of Tropical Research of The New York Botanical Garden, and others of the staff, have made many journeys to Venezuela and contiguous countries. These expeditions have explored the remote southern parts of Venezuela, from the borders of British Guiana and Brazil to the frontiers of Colombia, searching for new plants. These expeditions have had the generous financial support and interest of various friends of the Garden.

When these explorations began, Dr. Maguire maintained close relations with the late Dr. Henri François Pittier, founder of the *Instituto Botánico.* The connection has been continued through Dr. Tobias Lasser, now Director of the *Instituto* and founder (in 1945) and Director of the *Jardín Botánico.* Dr. Lasser attended the University of Michigan and pursued graduate studies under Dr. William C. Steere, now Director of The New York Botanical Garden.

The *Instituto Botánico* is housed in a building which stands within the grounds of the *Jardín Botánico,* and whose architecture is in keeping with buildings of the university *(Universidad Central de Venezuela).* The university supports and maintains the botanical garden. The institute is supported and directed by the Department of Renewable Natural Resources *(Recursos Naturales Renovables)* of the *Ministerio de Agricultura y Cria.*

The *Instituto* contains a herbarium, a library, lecture rooms, laboratories, and offices for members of the staff. The present staff includes Dr. Lasser, Director; Dr. Leandro Aristeguieta, curator of the herbarium and specialist on *Compositae;* Dr. Volkmar Vareschi, ecologist and specialist on ferns and lichens; Dr. Ernesto Foldats, specialist on orchids and marine algae; Dr. Zoraida Luces de Febres, specialist on grasses; and Dr. Julian A. Steyermark, specialist on *Rubiaceae.*

The building is modern, with fluorescent lighting; part of it is air-conditioned. The patios create a gay and charming atmosphere through colorful plantings, which are exposed to sun and rain throughout the year. In one, which is adjacent to the herbarium and offices, is a pool filled with ever-blooming, fragrant, purple and white water-lilies *(Nymphaea).* In other patios there are borders of purple-leaved *Setcreasea* and green-and-white *Chlorophytum comosum,* with backgrounds of graceful palms *(Chrysalidocarpus lutescens),* birds-of-paradise *(Strelitzia),* shell-flowers *(Alpinia),* and the decorative foliage of prayer-plants and other species of *Maranta.*

The herbarium *(Herbario Nacional de Venezuela)* contains approximately fifty thousand mounted specimens arranged in modern steel cabinets such as are used in herbariums throughout the world. The collection, begun by the illustrious Dr. Pittier, was the basis of his *Plantas usuales de Venezuela* (1926), in which more than six thousand species of vascular plants were listed. The growing collection later provided the materials for the *Catálogo de la flora venezolana* (1945–1947) compiled by Pittier, Lasser,

The Instituto Botánico in the foreground, showing part of the palmetum and conservatories, with the City of Caracas and Avita Mountain in the background.

Schnee, Luces de Febres, and Badillo. Nearly ten thousand species were treated in this work. The herbarium now serves for present studies on the flora of Venezuela. Since the publication of the *Catálogo* many specimens have been added from the collections of members of the staffs of the *Instituto* and of the *Ministerio,* and by the expeditions of Dr. Maguire and his colleagues at The New York Botanical Garden. Many of these specimens represent genera and species new to science; many others are of genera and species new to Venezuela. It is estimated that the Venezuelan flora consists of at least twenty thousand species of vascular plants. This is considered a conservative figure; the number may be thirty thousand when all parts of the country are better known and have been more thoroughly sampled, and when all the plants have been more thoroughly studied. Indeed, despite the explorations mentioned above, the botanical study of Venezuela is only beginning. All parts of the country need thorough collecting. Its botanical resources seem inexhaustible, for each expedition comes back with a wealth of new discoveries. The newly discovered species are important not only to a knowledge of the flora of Venezuela, but also to our understanding of the distribution of plants over the earth and of the evolutionary relationships of genera and species. Moreover, they may provide new plants for studies in genetics, morphology, and physiology, and for economic and horticultural uses. The wealth of native species that await propagation in gardens and conservatories presents a tremendous challenge for coming years.

The *Instituto Botánico* is planning to produce an illustrated treatise on the flora of Venezuela, and since The New York Botanical Garden, through Dr. Maguire's work, has the largest and most important collection of Venezuelan plants, the *Instituto* collaborates closely with the Garden. The Garden, in turn, is planning eventual publication of a Flora of Guayana (an area that does not correspond to national boundaries but includes more than half of Venezuela), and is naturally associated with the *Instituto* in this project. As already stated, the herbarium of the *Instituto* has received thousands of specimens from the expeditions made by The New York Botanical Garden under Dr. Maguire. In exchange, the *Instituto* has sent sets of plants collected by members of its staff to the herbarium of the Garden. This constant flow of exchange specimens will undoubtedly continue between the two institutions.

The botanical garden of Caracas occupies seventy hec-

This thoroughfare for automobiles in the Botanical Garden is lined with *Roystonea regia*. Clumps of the yellow-flowered *Galphimia glabra* grow between the bases of the palms.

Above. *Washingtonia* palms around the margin of a lake with *Chrysalidocarpus lutescens* in the mid-foreground.

Below. The aquatic plants around this part of the lake include *Eichhornia crassipes* along the margin, *Cyperus papyrus* with Washingtonia palms, and *Salvinia, Azolla, Eleocharis,* and *Limnocharis.*

Hymenocallis and *Hippeastrum* border a path adjacent to the tropical forest.

Along a path in the tropical forest of the Botanical Garden—*Curculigo* at left and climbing-aroids on tree trunks.

tares (approximately one hundred and seventy-four acres) of largely hilly land. The hills are part of the northern slopes of a range of small mountains south of the Valley of Caracas. The purpose of the *Jardín* is to grow all the species, native and foreign, that can be grown in that place. Of about twenty-five hundred species now cultivated in the garden, some seventy per cent are native to Venezuela. The garden's altitude of approximately three thousand feet above sea level limits the number that can survive. Native species ordinarily found from sea level up to about four thousand feet maintain themselves and thrive. Those of the higher altitudes of the Andes and the paramos do not withstand the dry heat of Caracas, nor do many of the species of the cloud-forest. An attempt to grow some of the unique and ornamental plants from the sandstone plateaus and mesas of Guayana has mostly failed. But there is a great opportunity for adding rare and beautiful plants to those already cultivated in the *Jardín Botánico.*

The garden is in several parts: 1) the palmetum, in the southern section, includes nearly one hundred species of palms. An avenue of royal palm *(Roystonea regia)* borders a drive which leads to the *Instituto.* The Californian *Wash-*

Upper. *Agave, Yucca,* and cacti, with *Washingtonia* palms in the background, in the succulent collection.

Lower. *Sedum, Yucca, Pennisetum,* and cacti in the succulent collection.

ingtonia grows here, beside a pool; also *Sabal, Livistona, Elaeis,* and many others. Some produce flowers and fruit when quite young; others have showy clusters of scarlet or yellow fruits when only five or ten feet tall.

2) The succulent collection includes characteristic plants of desert and other arid regions, not only from Venezuela but from other parts of South America, and from Mexico and Africa. Rocks and bare areas provide a natural setting for many plants of *Agave, Aloë, Sedum, Kalanchoë, Crassula, Euphorbia, Opuntia, Cephalocereus, Stapelia,* and many other genera. Some of the plants that New Yorkers grow in their houses make here an outdoor display the year around. Such species as *Aloë arborescens,* which do not usually flower indoors in the northern United States, here produce tall, showy spires of scarlet blossoms outdoors. *Agave,* also *Yucca,* and other genera thrive outdoors in the *Jardín* and make a fine display of color with their diverse flowers.

3) The aquatic plant collection occupies several pools in the garden. Some pools contain water-lilies *(Nymphaea)* bordered by white-flowered *Sagittaria* and clumps of graceful *Cyperus.* Others are covered with water-hyacinth *(Eichhornia crassipes),* water-poppy *(Hydrocleis nymphoides),* or *Salvinia* and *Azolla,* bordered by Egyptian papyrus *(Cyperus papyrus),* spike-sedge *(Eleocharis),* blue-flowered *Hydrolea spinosa,* yellow-flowered *Jussiaea,* and *Washingtonia.* Still others grow moriche palm *(Mauritia)* flanked by clumps of the aroid *Spathiphyllum.*

4) The tropical forest is one of the very attractive parts of the garden. It is an extensive naturalistic planting of woody and herbaceous plants characteristic of a rain-forest. One walks in deep shade through a luxuriant cover of ferns, aroids, begonias, amaryllids such as *Crinum, Eucharis,* and *Hymenocallis, Marantaceae, Zingiberaceae, Musaceae,* and many other kinds of plants. The trunks of the trees are clothed with the various greens of climbing aroids *(Syngonium, Philodendron, Scindapsus, Monstera,* and others). Overhead are festoons of vines of the aroid, bignonia, and cucumber families. The forest canopy itself is made by such trees as miao *(Anacardium rhinocarpus),* matapalo *(Ficus),* copey *(Clusia),* jabillo *(Hura crepitans),* bucare *(Erythrina),* and caro *(Enterolobium).* Some branches are covered with bromeliads and orchids. The impression gained from some of the houses in the Conservatory of The New York Botanical Garden is reminiscent of the amazing effect of this forest in the botanical garden in Caracas.

Along some of the more open paths leading into the tropical forest, color is furnished by shade-loving plants such as *Hemigraphis colorata,* by the orange-red amaryllis *(Hippeastrum),* the fragrant, white spider-lily *(Hymenocallis),* the Amazon-lily *(Eucharis grandiflora), Neomarica northiana,* the red-flowered *Sprekelia, Trimezia, Zephyranthes,* and others. Planted in drifts, in the openings adjacent to these paths, the pink-, rose-, and white-flowered clumps of *Zephyranthes* or Atamasco-lily produce an effect in March and April comparable to that of crocus during their flowering period in the United States.

5) The collection of economic plants represents species,

Zephyranthes, or Atamasco-lily, resembles *Crocus.* Here many are in bloom in the Botanical Garden of Caracas at the time crocuses are flowering in early spring in the United States.

native and foreign, grown for food, medicine, horticulture, fibers, resins, gums, and latex. The plants are arranged in formal beds adapted to the instruction of university classes.

6) An orchidarium is situated on a slope above the tropical forest. The species represented are mostly Venezuelan. Because of the heat, it is impossible to grow orchids of the cooler Andean forests. And because of the dry air, most of the orchids of the moist cloud-forests cannot survive in Caracas.

7) There are two separate conservatories. In them more delicate plants are grown in a more humid air and are protected from wind and sun. A number of ferns, aroids, bromeliads, peperomias, begonias, gesneriads, and species of *Acanthaceae* thrive under these conditions.

8) A nursery is maintained for the propagation of the plants used in the various parts of the garden. Herbaceous plants and woody vines, shrubs, and trees are grown from seeds, cuttings, and leaves.

9) The arboretum is the largest division of the garden. A part of the valley is planted to foreign and native trees arranged by families. The rest of the arboretum covers the hills that rise above the *Instituto* and lend green cover and wild beauty to Caracas. With the adjacent forested park of Los Caobos ("the mahoganies," which dominate the park), and other parks scattered through the city, the wooded hills of the botanical garden help to maintain a healthful and purified air in the city itself.

The hills on the grounds have been reforested. In the original planting *Cassia siamea* and foreign species of *Eucalyptus* and *Casuarina* were used, but recently emphasis has been placed on native trees. About one hundred and fifty thousand trees have been planted in the last fifteen years, an average of ten thousand a year. The saplings from the nursery are set out on the hills and not watered, for the arboretum is too large for daily care. They must therefore be trees that can tolerate the dry season that prevails between December and mid-April. (Other parts of the garden are watered regularly during this season.) Within twenty years from planting, the saplings will have become large enough to make a true woodland. Some of the native trees used are species of *Ficus, Persea, Cassia, Clusia, Erythrina, Tabebuia,* and *Jacaranda.* The first two of these, and some others, hold their leaves through the year. The last three drop their leaves in the dry season but provide massed displays of orange, yellow, and purple. The commonest of the larger native trees already found on the hills are mahogany *(Swietenia),* fig *(Ficus),* bucare *(Erythrina),* and a number of leguminous species. The bucares are clad with brilliant orange blossoms; *Jacaranda* and some of the others have showy purple flowers.

This reforestation should serve to indicate which native species are best adapted to the deforested slopes of Avila Mountain. Each successive Minister of Agriculture has considered the reforestation of Avila of major importance; the *Jardín Botánico* expects to provide the knowledge necessary for the best results.

RESEARCH ON NEMATODES (Continued from page 164)

covery opened up new areas of study, and search began for other nematodes which attack plants from within or without. The search still continues.

Plant specialists have learned that nematodes are responsible for damage that has been ascribed to drought, flood, soil depletion, and other causes. The minuteness of the animals and their slow but steady population-growth has often caused plant-damage imperceptible to the grower.

Plant-damage is hard to evaluate accurately, since the feeding nematodes can carry with them virus colonies which may infect the plant with a particular disease. They have not been found to transmit bacteria, but their probing into plant cells may open wounds which can be infected by soil bacteria.

Asparagus seems to be unattractive to virtually all nematodes, and the marigold secretes a substance toxic to many of them. So effective is its ability to discourage invasion by certain nematode species that the marigold is now interplanted with tea in the plantations of Ceylon.

At Rutgers University, nematodes have been under study for many years, beginning with the observations of Conrad Hensler during his almost half-century of service in the College of Agriculture's Experiment Station. Entomologist Dr. Martin Hutchinson began the first full-fledged studies of nematodes in 1955 and laid the groundwork for the present operations of nematologist Dr. William R. Jenkins. Dr. Jenkins, who came to Rutgers in 1960 from the University of Maryland, considers the nematode one of nature's most fascinating creatures. His interest in them started at the University of Virginia, where he won his master's degree. His doctorate is from the University of Maryland.

Three specialists, Dr. Jack D. Tiner, Ronald A. Davis, and John P. Reed, and seven graduate-students round out Dr. Jenkins' staff. Research is being carried on in three general areas. Because of the economic importance, work on developing and testing new nematocides forms a substantial part of the program. The relationship between the nematode and its hosts, principally plants, is under study from its basic biological aspect, and a third area is the fundamental work on such phenomena as the inherent resistance of certain plants and the relatively greater resistance of certain strains of specific plants.

Dr. Tiner, whose research is supported by a National Institutes of Health grant, has been engaged in efforts to grow nematodes in sterile cultures so that they may be studied in an environment free from contamination and extraneous influences. With the aid of ingenious but elaborate apparatus, he has succeeded in raising the worms in a scientifically clean environment, opening the door to accurate studies of their basic biological functions.

An interesting line of study, which the scientists at Rutgers hope to pursue, is the infestation of insects by nematodes and the possibility of biological controls of insects by nematodes.

Another interesting study is being done by Dr. David Pramer, Associate Professor of microbiology. He is investigating the long-known phenomenon that particular soil fungi ensnare and eat nematodes. The fungi employ a variety of ingenious traps, ranging from microscopic lassos that encircle and grip the worms to adhesive-coated knobs or stalks that are as effective as flypaper. These highly specialized fungi are present in large numbers in the soil and

(Continued on page 182)

Lonicera henyri is a well-behaved evergreen honeysuckle vine.

VINES AND GROUNDCOVERS FOR A LIMITED SPACE

By HAROLD O. PERKINS

Mr. Perkins, Emeritus Professor of Landscape Design, University of Connecticut, is now practising as a landscape architect in Storrs, Connecticut. He is also a member of the American Society of Landscape Architects.

PART I — VINES

IF YOU WERE ASKED to name three vines in quick order, the chances are that you would come up with wisteria, Boston ivy, and woodbine—or perhaps you would include trumpet-vine or climbing hydrangeas. All are good vines—in the right place; but that place is hardly the smaller house lot which predominates in present-day suburbia. These vines were used on and about the large mansions of another period. Modern living is somewhat more telescoped, and houses are smaller. In looking for plants to satisfy new needs, we should not be overly sentimental and insist on grandmother's favorite specimens. We should look at the new "compacts." Vines by their very nature are rampant, but there are varieties that are quite restrained in habit. It may take more hunting to find them in the market, but they will prove more satisfying over the years.

THE NEW "COMPACTS"

The vines to be mentioned are not new in the real sense of the word, for they have been known and grown in arboretums and botanical gardens for several decades. However, slow-growing plants have never been very popular with commercial growers, so that the more restrained vines are not as commonly available as they should be. (And for this, the price-tag-watching public should be blamed, not the nurseryman.)

Plantsmen occasionally find natural dwarfs of common species of trees and shrubs. This has happened less frequently with vines, but there are a few good ones that fit into the designer's kit. Lows ivy, baby and Kew wintercreeper, and small-leaf English ivy are dwarf clones of the well-known Boston ivy, wintercreeper, and English ivy.

Lows ivy *(Parthenocissus tricuspidata lowii)* has a smaller leaf than that of the type plant. The leaf is also more deeply cut, and its edge has a distinctive curl. The natural spread of this vine is less than a fifth of that of Boston ivy, and it is easily restrained to even less than that.

Baby wintercreeper *(Euonymus fortunei minimus)* has a dainty leaf that is little more than one-half inch long. The plant itself grows only a few feet high. The common wintercreeper *(Euonymus fortunei radicans)* has a leaf about twice the size of the baby wintercreeper, but this is still much smaller than the more frequently used wintercreepers, such as *E. f. vegetus* or *E. f. carrierei.* The common wintercreeper grows to fifteen feet or more. The smallest one of the group is Kew wintercreeper *(Euonymus fortunei kewensis)*; its leaf is less than one half inch in length, and the plant will grow about eighteen inches high. Kew wintercreeper provides a delicate pattern against a low wall or on a large stone in the garden.

Small-leaf English ivy *(Hedera helix minima)* is one of the smaller-leaved clones that is grown out-of-doors; it

tends to revert to the larger leaf found on the original type plant. *H. helix minima* is not reliably hardy north of New York City. The Baltic ivy *(Hedera helix baltica)* is one of the hardiest varieties and is commonly grown. It should be planted on the north side of a building and not be exposed to strong winds. If planted where the winter sun strikes it, "burning" will take place, and the plant may become completely defoliated in the spring. The Baltic ivy has a smaller leaf than the type and does not grow as tall, although it is still a large vine unless restrained.

Many vines would benefit from some restrictive pruning. By this I mean that the landscape design effect would be improved, if vines were thinned out and pruned back so that they would provide an interesting tracery of stem and foliage rather than a massive blob of leaves. Beautiful stone walls are all too often hidden by a curtain of green when vines are permitted to do "what comes naturally."

All these vines have rootlike holdfasts that will cling to a masonry surface. They should not be grown over a wooden structure, since they would cause considerable damage. Except for the Lows ivy, the vines discussed so far are evergreen.

A Honeysuckle That Stays Put

Honeysuckle vines have the reputation of being rambunctious, a reputation that has been well established by the commonly used Japanese honeysuckle. But we should not cross off our list all vines with the name honeysuckle. Henry honeysuckle *(Lonicera henryi)* is deserving of a better fate. It resembles its more infamous cousin from the Orient, but its mature height of fifteen feet would rate it as a small vine. It is completely evergreen, and the moderately wide spacing between the leaves shows the stem to advantage. Except in cold winter weather, when its moderately large leaves roll up tightly, it is a well-behaved vine. True, the dull bluish pink flowers leave something to be desired, but the large cluster of firm dark blue berries is a real surprise. The fruit with a section of the stem can be used to make interesting arrangements for the table in early winter.

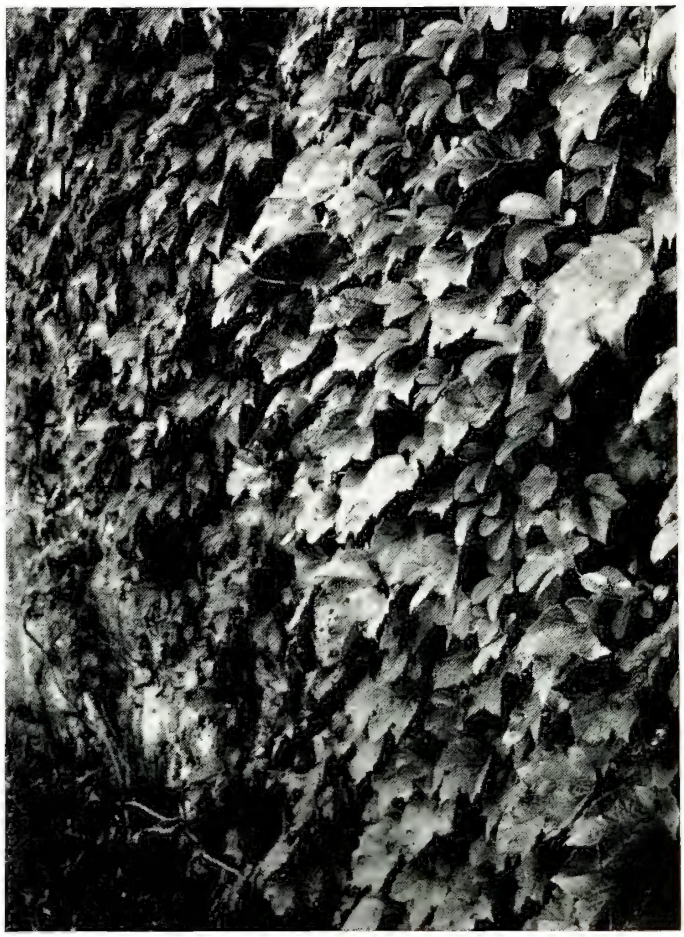
There are three non-evergreen vines suitable for limited space. The trio is composed of akebia, clematis (large-flowered hybrids), and turquoise berry. Although the akebia and the turquoise berry may ramble out of bounds, a little timely attention will keep the plants under control since the stems are slender and easily cut. The foliage of both has interesting outlines and creates an impression of lightness, even though the leaves are not really small.

The leaf of akebia *(Akebia quinata)* is made up of five fingers, each held on a small stem. The dark green color gives it a rich appearance. This vine provides light shade for an arbor or a tracery of green on a downspout or fence.

Turquoise berry *(Ampelopsis brevipedunculata)* has a three-lobed leaf. The grape-like cluster of fruit always attracts the eye. The berries in an individual cluster ripen at different times; some resemble a small robin's egg, both as to color and spotting, while others are pale green, lavender, or blue-black. The related monkshood vine *(Ampelopsis aconitifolia)* has a more delicately cut leaf, but its fruit is not as interesting. You may take your choice: delicate leaf pattern or interesting fruit.

Akebia quinata.

Parthenocissus tricuspidata.



The large-flowered hybrid clematis are the glamour vines of the mid-century period. There is a good range of clear colors and the beautifully formed flowers are real attention-getters. The fact that they may measure six inches, or even more, in diameter does not lessen their attractiveness. The stamens and pistils at the center are worthy of a closer look. In some varieties they have the appearance of a queen's crown, and this, set against a royal purple or ermine background of sepals, is beauty at its finest. The next opportunity you have, why not take that second look? Most vines are rugged individuals and require little in the way of care. Clematis is more exacting in its cultural requirements; but, after all, royalty is deserving of attention.

Vines have been playing a secondary role in landscape plantings within recent years. If a switch were made from the standard fifty-foot by fifty-foot vine, and some thought were given to thinning, we could again enjoy the tracery patterns and the softening touches that vines provide.

Clematis 'Lady Carolina Neville' is a delicate mauve, pale enough to be called French-gray or French-white, with a somewhat darker mauve bar down the center of each petal.

PART II — GROUNDCOVER PLANTS

GROUNDCOVER PLANTS are favorites of today's amateur gardeners. They look to these plants for an easy solution to their garden maintenance problems and expect them to grow where nothing else has grown before. True, many of the groundcover plants will thrive in problem areas, but even they require some attention, and especially while they are becoming established. We should never be too hasty in dismissing the use of turf areas; we must recognize that grass will take more punishment than any other groundcover when it is walked on. The lawn mower is the great leveler to a weedy lawn, so that some weeds can easily masquerade as grass. And herbicides have been developed for use on turf areas. However, they cannot very well be used to eliminate weeds in a groundcover planting.

The recent lavish use of groundcover plants has been wonderful for gardeners of large lots as well as small. Just don't expect too much, however; groundcover plants are not really the long-sought answer for the no-work, hammock gardener.

Ampelopsis brevipedunculata.

So many kinds of plants can be used as groundcovers that it will simplify matters if I classify them into several groups and then narrow the discussion to a few of the more refined varieties.

WOODY OR HERBACEOUS TYPES

Groundcover plants may be woody or herbaceous. The woody group can be deciduous or evergreen, with the latter group subdivided into needle-evergreen and broad-leaved evergreen. The herbaceous perennial group can be divided into non-evergreen and evergreen. In this discussion, since space is limited, only the various types of evergreen foliage plants will be mentioned. This automatically eliminates some of the weedier plants, and some very choice plants will also automatically be excluded.

The broad-leaved evergreen woody plants are universal favorites and are popular items in the garden centers. Myrtle or small-leaved periwinkle *(Vinca minor)* has been used for hundreds of years, and its dark green color gives a richness to almost any planting. It will grow under deciduous plants to give winter color and to lessen any ungainly effect that a leggy plant may possess. 'Bowles Variety' forms a clump and thus is not as spreading as the type. It has a larger flower.

Baltic ivy *(Hedera helix baltica)* has a dark green leaf. It should not be used on the south side of a building, but

as a groundcover it will withstand partial sun better than it will when used as a vine. That its small-lobed leaf has appealed to artists as well as gardeners is evidenced by its wide use in scrolls and architectural decoration.

Japanese spurge *(Pachysandra terminalis),* compared to myrtle and Baltic ivy, is a newcomer; it was popularized by landscape architects not many more than twenty-five years ago. Today, even its scientific name is a household word. *Pachysandra terminalis variegata,* with a two-tone leaf in creamy white and green, sends out few underground stems and so is very slow in filling in an area.

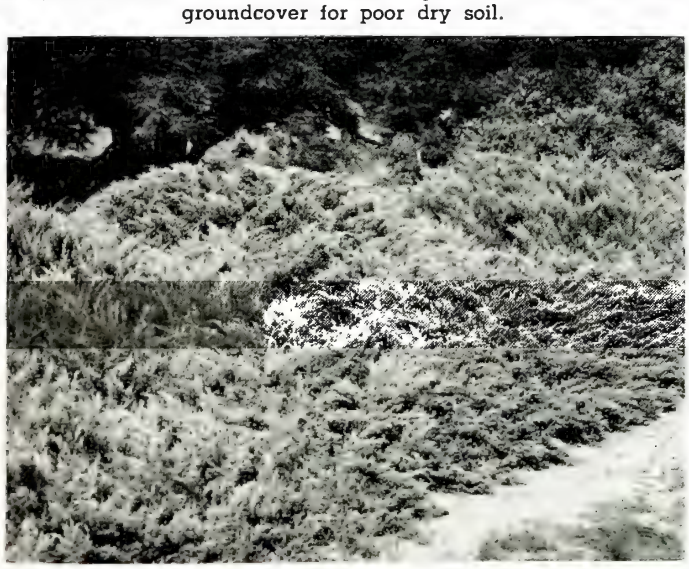
Purple wintercreeper *(Euonymus fortunei colorata)* is one of the hardiest of the broad-leaved evergreen group and one which does well in the Midwest. The leaves turn a purplish red when cold weather comes, and this color is retained throughout the winter. At other times, the leaf is a dark green.

Silveredge wintercreeper *(Euonymus fortunei gracilis)* is a variegated form combining green and white. The irregular white edging contrasts nicely with the dark green of the leaf. The leaf is small, little more than an inch in length. The silveredge wintercreeper is a slow grower, so the plants should be placed quite closely.

Variegated forms are commonly ignored by garden designers. However, in a dark corner a plant with white edging gives lightness and gaiety to the scene. If a quick cover of a variegated plant is wanted, one should look to the nonevergreen herbaceous perennials and especially to selected clones of *Hosta, Ajuga,* and *Aegopodium.*

Most broad-leaved evergreens do best in partial shade, but bearberry *(Arctostaphylos uva-ursi)* thrives in sun and sandy soil. Unfortunately, it is difficult to transplant and is slow in becoming established. The small leaf of the bearberry permits a pleasing change of texture. Another native that has a leaf of similar size is coming into garden centers in increasing numbers. This newcomer is shore cowberry *(Vaccinium vitis-idaea majus).* Its glossy leaf and dark red berries are most attractive. It does not spread rapidly; it would therefore be used only in small areas. That it will thrive only in areas with an acid soil places some limitation on its use.

Sargent juniper *(Juniperus chinensis sargenti)* is a low evergreen groundcover for poor dry soil.



Junipers for Sun

The several prostrate junipers are the answer to the question, "What can I use on a sunny bank—something that will not take over the place?" (Since junipers do insist on sun, if some taller plant is used nearby, its growing, spreading branches will kill out the juniper.)

Many selections have been made of Bar Harbor juniper. Several of these are better than the type and certainly they are easier to find in nurseries and garden centers. Wilton juniper *(Juniperus horizontalis glauca)* is one of the choicest. Its new foliage is a pleasing bluish gray, and it retains a good green tone all winter instead of turning a smoky purple as does the original species. A mature plant is little more than a foot high, and its total spread may be at least four or five feet. Andorra juniper *(Juniperus horizontalis plumosa)* will grow two feet tall and is of a looser habit than others of this type. It grows quite rapidly. These two are selections of plants that were originally found around Bar Harbor, Maine. The latter plant was named for the Andorra Nurseries of the Philadelphia area. Sargent juniper *(Juniperus chinensis sargenti)* is yet another of these low spreading evergreens that have not been used as much as they should be.

Actually, many good plants have not been able to break the economy barrier. Nurserymen must live, meet a payroll, and answer to the tax man. So "bread and butter" plants continue to be popular largely because they can be bought at attractive prices. Since garden centers are geared to serve a large public, they tend to stock only those plants that sell quickly. Another choice plant that has lost out in the current market is the spreading English yew *(Taxus baccata repandens).* It is so much hardier than other English yews that a few plantsmen question its classification. Some yews may become somewhat leggy, but never this plant—it is always full to the ground. In fact, if it is planted at the top of a wall, its pendulous branches will trail several feet below.

Evergreen Perennials

If there is one classification of plants that has been neglected, it is the evergreen herbaceous perennials. Yet

Andorra juniper *(Juniperus horizontalis plumosa)* forms a low, flat mass. Here *Lavendula* edges the planting.

among them are some very neat and interesting plants. They are frequently "off-beat" plants, yet of good family. Sometimes they are conversation pieces and have a story to tell.

Oconee-bell *(Shortia galacifolia)* is such a plant. Its rounded, glossy leaf is most attractive, and its white bell-like flowers early in the spring make one want to get down on hands and knees to take a closer look. As for its story—Dr. Asa Gray, the renowned botanist, spent years and years hunting for this "lost" plant in its native South Carolina where only limited colonies of it existed. *S. galacifolia* is hardy into New England, but give it shade and some moisture in the summer.

Galax *(Galax aphylla)* is somewhat similar but has a larger leaf and bears a white spike-like bloom in summer.

European wild ginger *(Asarum europaeum)* has a heart-shaped, very dark green, and glossy leaf that is smaller than the leaf of our native wild ginger. The plant makes a dense mat of foliage and prefers shade, summer moisture, and a good soil.

A new interest is developing in hen-and-chickens or houseleeks. It may surprise some of my readers to learn that these succulents are so winter-hardy that they flourish without protection into central New England. As these plants spread, they make a compact mat. The variation in size of plants and in the taller flower shoots furnishes a beautiful pattern. Sempervivums combine nicely with a pebble area or can be set off well near paving or a mulched area of vermiculite. They produce a rosette of foliage. Some varieties have a large rosette, while others have quite small rosettes; some have an interesting spider-web effect at the center; others are tipped with reddish purple, or the entire leaf may be colored. Here is an old-fashioned plant that can be used to give a modern touch to the garden. One of the more common large houseleeks is *Sempervivum tectorum;* one with a small rosette of foliage is *Sempervivum flagelliforme.* The latter has pale green pulpy leaves with no touch of red on the tips.

So many plants can be used as groundcovers that it is well to look at trial plantings before you make your final selection. There are at least two such trial grounds where many plants are displayed. One is at the Morton Arboretum in Lisle, Illinois, and the other is at the Case Estate (of the Arnold Arboretum) in Weston, Massachusetts. Study these and other display plantings. Look once for height and matting quality, once for color, and then half close your eyes and study the textural quality.

RESEARCH ON NEMATODES (Continued from page 177)

are doubtless one of nature's controls of the nematode population. They have remained largely scientific curiosities, but Dr. Pramer is keenly interested in the possibilities of putting them actively to work in the continuing battle against the nematode.

The program of basic research on the nematode and its practical control, which is engaging the attention of the Department of Entomology at Rutgers, is of real interest not only to agriculturists but to horticulturists. The Department is concerning itself with nematodes that attack ornamental plants as well as those that attack farm crops. Fieldwise, about fifty shrubs are being given what Dr. Jenkins described to the Editor of *The Garden Journal* as "shot-gun" treatments with nematocides. These treatments are being observed for the specific control of nematodes and for any effects, good or ill, that they may have upon particular shrubs. Among the ornamentals in these tests are several species and varieties of hollies, yews, boxwood, forsythia, roses, and carnations.

The above is based on *A Brief Report from Rutgers, The State University,* May, 1961.

European wild ginger *(Asarum europaeum)* is used as a groundcover in the Thompson Memorial Rock Garden of The New York Botanical Garden.

A SHRUB BORDER IN A SOUTHERN GARDEN

By JUNE RAINSFORD HENDERSON

June Rainsford (Mrs. Peronneau Finley) Henderson, horticulturist, author, and lecturer, has seriously pursued her hobby ever since she became interested in gardening at her grandmother's home in Edgefield, South Carolina. While engaged in research at the Library of Congress in Washington, D. C., she gathered information on eighteenth-century gardens. In 1938 her book *Floralia, Garden Paths and Bypaths of the 18th Century,* was published by the University of North Carolina Press. Appropriately, her home and garden in Aiken, South Carolina, are named "Floralia." Mrs. Henderson has received awards from the Garden Club of South Carolina, of which she is a former president, and from The Garden Club of America.

MORE THAN A DOZEN YEARS AGO a combination of time for gardening and an area in which to garden offered an opportunity to indulge in a planting project that had long been taking place in my imagination.

The eastern border of our property measures two hundred feet. The width of the border was to be determined by the type of plants that I wanted to use. After some experimentation, a width of fifteen feet proved adequate. A substantial brick wall opposite the house and from the end of that a hedge of cherry-laurel, *Prunus laurocerasus,* which extended to the end of the property line, formed a satisfactory background for the new planting. The only established plant in the border was a *Photinia glabra.* Although it was out of scale for a time, pruning brought it into bounds, and the lovely foliage has justified its retention.

My first difficulty was the choice of plant material. The climate and soil of this middle region of South Carolina make it possible to grow a wealth of evergreens as well as deciduous flowering shrubs. No truly southern planting can be made without camellias, azaleas, boxwood, hollies, and tea-olives *(Osmanthus),* which are among those plants most characteristic of this section of the country. Since the area to be planted was limited, my selection of plants was necessarily limited. I had been interested in hollies for some time and had nice specimens of different varieties growing in random spots about the place, so I decided to make this species the dominant evergreen. This has proven a happy and satisfactory choice.

With the exception of *Ilex vomitoria,* or yaupon, as I prefer to call it, I felt that the native American hollies attained too great a size for my restricted planting. I decided to use, for the most part, those from the Orient that thrive so well in this climate. *Ilex cornuta,* the Chinese holly, and *I. latifolia,* the Japanese holly or tarajo, were chosen for accent. These were planted at intervals in the back of the border where they would lend height, and they have been cultivated to become dominant. The rich, dark green leaves of *I. cornuta* with their many spines have been an interesting contrast in size, texture, and color to those of *I. latifolia,* which are from three to four inches long, leathery, and a lighter green.

A firm decision, made long before work began, was to use in the border only those plants that bear white blossoms. Azaleas were my first selection. Between the accent hollies, I measured areas fifteen feet long, and in these I planted Kurume and Indian azaleas. Flowers of the Kurume group, much smaller than those of the Indian, make up in profusion what they lack in size. From the Kurumes I chose the varieties 'Snow' and 'Snowflakes'. (I still do not know whether they are one and the same.) 'Snowflake' was on the list of original introductions of Kurumes made by the late Dr. Ernest H. Wilson, who was solely responsible for making this lovely variety known to American gardeners. My Kurumes have proven to be dense, compact growers and very free-flowering. Each year for from two to three weeks in March the bushes are completely covered with snow-white blossoms. The double hose-in-hose flowers seem to last longer than the single ones.

Between the Kurumes and the background hedge I planted Indian azaleas, which are large-flowered, evergreen, and taller-growing than the Kurumes. The azaleas that have made "Magnolia," "Middleton," and other gardens around Charleston famous belong to this group. I selected two varieties which are strong-growing and very hardy, 'Fielder's White' and 'Indica Alba'. Both produce large, pure white blooms; as the former comes into flower ahead of the latter, the season is extended. Five years ago a severe late-spring freeze did great damage to all the Indian azaleas in this region. However, those that were not killed outright made rapid recovery, and this past spring there was no evidence of damage.

Cydonia or flowering quince has long been a favorite—because it is dependable for blooms from late winter into spring—and so the white-flowered variety was my first choice among the deciduous shrubs. It is best displayed in group plantings of three plants to a group. The evergreen background is not only satisfactory when this shrub is in flower, but also when it is dormant, for the flowering quince is straggly in growth habit.

Two deciduous natives, *Cercis* or Judas-tree and *Callicarpa* or beauty-berry, grow abundantly throughout the South. Each has a white form that is rare and very beautiful. White Judas *(Cercis canadensis alba),* as also *Cydonia,* furnishes when dormant a pleasing contrast with the evergreens; in spring the bare branches are covered with exquisite small white blossoms. The dense clusters of white berries on the leafless stems of *Callicarpa* in early autumn are unusual and very ornamental. This plant is difficult to procure and difficult to grow, but any measure of success is worth the effort. Another deciduous shrub that belongs in the same category of difficult to grow but rewarding is *Stewartia.* Among the several species is *S. malacodendron,* native to South Carolina and other southern states. The foliage is handsome, and the flower, resembling a glorified single white camellia, is very showy; its center is a crown of reddish purple stamens. *S. malacodendron* will in time reach the size of a tree, but so far mine has remained shrublike in proportion.

Ilex latifolia is used as an accent shrub and *Ilex crenata helleri* as an edging in the author's shrub border.

After the large evergreens and flowering shrubs were settled in their places, there were voids to be filled. Yaupon, the small-leaved native, was the only American holly to be given a place in the border. An occasional plant of the Chinese *Ilex pernyi* was added, primarily because it is slow-growing and because its small spiny leaves lend an unusual note. The low-growing Japanese hollies were most useful as fillers, and for this purpose I chose *I. crenata rotundifolia* and *I. crenata microphylla.* However, in my opinion, *I. crenata helleri* is superior to all hollies in this class. It is unexcelled as a border plant, because of its increasingly solid mound of green leaves. It has been used as an edging in front of the large hollies, while ivy borders the azaleas.

I did not adhere to the pattern of planting, as described above, for the terminal fifty feet. Since this area extends beyond the house, there is enough space to accommodate larger plants. The white-blooming magnolias, *M. stellata* with its fragile starlike flowers and *M. soulangeana alba,* furnish variety to the masses of bloom produced by spiraeas, *Philadelphus* or mock-orange, and *Exochorda* or pearl-bush.

For a stretch of about forty feet opposite the long border and along the side of the house is another planting of green and white which is more specialized. This little garden, which can be seen from the dining room, gives much pleasure when in bloom. A large *Elaeagnus pungens fruitlandii,* whose dark green leaves have bright silver under sides, fills the corner where the bow-window projects from the house.

For this border I have again used *Ilex cornuta* as the center, flanked on each side by *Podocarpus.* These have been kept trimmed to form narrow columns. Lower in height than the holly and planted equidistant to make a loose semicircle are eight specimens of *Camellia japonica.*

Since few white camellias stand the cold weather very well, varieties were chosen for their hardiness rather than for the spectacular size of their blooms. These were also selected because they can be counted on to bloom at approximately the same time: 'Leucantha' or 'Tricolor White', which produces a shower of single white blooms; the semi-double 'Louise-Onetta' and 'Imura', both dependable; and two seedlings, 'Eleanor Merry' and 'Adelaide', which are equally as good as 'Leucantha' and perhaps more cold-hardy. These seedlings are gifts from my daughter's garden.

Since I feel that camellias need accompanying bloom, I sought a variety of azalea (most of them bloom after the camellia season) and was rewarded when I found the early-blooming Glenn Dale hybrid called 'Cantabile'. It does not give profusion of bloom, nor are the individual flowers very large, but 'Cantabile' is apparently quite cold-resistant and fills the area around the camellias very acceptably. Another Glenn Dale hybrid, 'Treasure', which does have spectacular large white blossoms, fills in some spaces and blooms with the tulips. These are planted in a double row just back of dwarf English boxwood *(Buxus suffruticosa).* Between the boxwood and the old bricks that edge the border the hardy perennial *Iberis sempervirens* or candytuft can be relied on for a broad mass of blooms each spring. *Vinca minor alba* is used as a groundcover wherever one is needed.

Naturally within a limited area it has been necessary to omit some very desirable plants. There is constant moving and replacing of shrubs. For example, loquat *(Eriobotrya japonica)* is one of my favorite evergreens, and I like to have two or three growing in the border. Their large interestingly veined leaves contrast with the other foliage nearby. Loquat grows slowly until it is five or six years old and can be kept to a single stem; after that it develops rapidly into a large spreading shrub. When this development begins, the plant is moved out and given to a friend or planted near the southern boundary at the back of our place. A year ago a nurseryman bought two hollies that were getting out of bounds, to plant on an estate nearby. To take their place I put in shrubs that will never attain the size of the hollies.

In creating my borders I have had three aims: first, for a green effect in winter; second, for a wealth of bloom in spring; and third, for as much ease of maintenance as possible during summer. I have attained a certain measure of success, but I am still learning. After a decade some of the planting looks quite finished, but there is still opportunity for further experimentation.

BOOK ORDERS

Books reviewed in *The Garden Journal* or any other book on botany, horticulture, nature study, conservation, flower arranging, or kindred subjects may be ordered through Book Service.

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BRIEF NOTES ON RECENT BOOKS

By ELIZABETH C. HALL

Miss Hall is Sarah Gildersleeve Fife Research Librarian of The New York Botanical Garden.

CONSERVATION, NATIONAL PARKS, SCIENCE PROJECTS, ETC.

FOREST MANAGEMENT; 2nd ed. Meyer, H. Arthur and others. 282 pages, illustrated, indexed, bibliography. Ronald Press Co., New York. 1961. $8.50

Since the first edition in 1952 there has been a marked transition from forest exploitation to sustained-yield management. This updated revision emphasizes the progress in forest regulation. Examples of management plans are presented for forests of various sizes in Massachusetts, Tennessee, Idaho, and California.

THE LIGHTNING BOOK. Viemeister, Peter E. 316 pages, illustrated, indexed, bibliography. Doubleday and Co., Garden City, N. Y. 1961. $4.50

This fascinating account, written for the layman by a technical engineer, includes history, superstitions, present-day findings, and practical advice on protection from lightning.

OUR COUNTRY'S NATIONAL PARKS; 50 STATES EDITION. Melbo, Irving Robert. 2 vols. 278, 278 pages, illustrated, indexed. Bobbs-Merrill Co., Indianapolis, Ind. 1961. per vol. $4.50; set $8.00

This new edition of a favorite work for young and old offers a full chapter on each of our twenty-nine national parks. Pleasant chatty accounts full of anecdotes, history, folk lore, and beautiful photographs.

OUR NATIONAL PARK POLICY: A CRITICAL HISTORY. Ise, John. 701 pages, maps, bibliography, indexed. Johns Hopkins Press, Baltimore, Md. 1961. $10.00

Richly documented account published for Resources for the Future, Inc. Mr. Ise has devoted many years to the analysis of conservation problems. His *United States Forest Policy* and *United States Oil Policy* are indeed conservation classics.

THE SCIENTIFIC AMERICAN BOOK OF PROJECTS FOR THE AMATEUR SCIENTIST. Stong, C. L. 584 pages, illustrated, indexed, maps, bibliography. Simon and Schuster, New York. 1960. $5.95

A how-to-do-it book of hundreds of fascinating projects in biology, physics, chemistry, mathematics, astronomy, archaeology, and geology. Those botanically minded should find of interest "Growing Algae on a Window Shelf," "How to Cultivate Harmless Bacteria," and "Chromatography."

THINGS TO DO IN SCIENCE AND CONSERVATION. Ashbaugh, Byron L. and Beuschlein, Muriel. 163 pages, illustrated, indexed, bibliography. Interstate Printers and Publishers, Danville, Ill. 1960. $2.50

Simple as well as more advanced experiments are suggested. A large range of subjects, such as sun, soil, air, water, minerals, plants, animals, space, electricity, synthetics, and nuclear energy. Information sources and teaching aids listed. Conservation stressed throughout.

FOR YOUNG READERS

THE BEGINNING GARDENER. Cutler, Katherine N. 173 pages, illustrated, indexed. M. Barrows and Co., New York. 1961. $2.95

Mrs. Cutler's *Junior Flower Arranging* published in 1954 has been found a very useful text for young arrangers and for leaders of Junior Garden Clubs. The author had wide experience as the first state chairman of Junior Gardening in New Jersey. Her recent book should be well received. A helpful section contains a list of some of the requirements for Girl Scout badges that pertain to botany and gardening.

FRUITS WE EAT. Fenton, Carroll Lane and Kitchen, Herminie. 128 pages, illustrated, indexed. John Day Co., New York. 1961. $3.50

This is the third book by the authors of *Plants That Feed Us* and *Animals That Help Us*. Dr. Fenton's illustrations are wonderfully done, with a pleasing softness. Mrs. Kitchen, Specialist Emeritus in Agricultural Information at Rutgers University, offers accurate facts, delightfully told. Over a hundred fruits are illustrated and described from temperate, tropical, and sub-tropical regions.

MY EASY-TO-READ TRUE BOOK OF TREES. Podendorf, Illa. 43 pages, illustrated (part colored). Childrens Press, New York. 1960. $1.00

For those just beginning to read.

NEW WORLDS THROUGH THE MICROSCOPE. Disraeli, Robert. 175 pages, illustrated. Viking Press, New York. 1960. $4.00

A revised edition of the 1939 edition of *Seeing the Universe* with expanded text and many new photographs. A strikingly complicated unseen world told and illustrated simply and expertly.

THE TALE OF A POND. Kane, Henry B. 121 pages, illustrated, indexed. Alfred A. Knopf, New York. 1960. $3.00

Equally charming and enchanting as Mr. Kane's previous title *The Tale of a Meadow*. Fresh water biology described and illustrated with dramatic feeling.

THERE STAND THE GIANTS: THE STORY OF THE REDWOOD TREES. Weaver, Harriett E. 70 pages, illustrated (part colored). (A Sunset Junior Book) Lane Book Co., Menlo Park, Cal. (Distributed in the East by J. B. Lippincott Co., Philadelphia, Pa.) 1960. $2.95

Ages 9 to 12 will like this fascinating story of the world's most famous trees. The author was formerly Ranger and Park Naturalist in Big Basin Redwoods State Park.

THE TREES AROUND US. Tee-Van, Helen Damrosch. 63 pages, illustrated. Dial Press, New York. 1960. $2.50

An exquisitely illustrated book, adapted from Coronet Instructional Films by Mrs. Tee-Van, well-known illustrator of undersea life in connection with Dr. Beebe's expeditions in the tropics. Although written for the primary grades, older readers will learn much about trees from the charming pictures and text.

UNDER THE SEA. Burton, Maurice. 256 pages, illustrated (part colored), indexed. (Illustrated Science Books) Franklin Watts, New York. 1960. $4.95

The inhabitants of the sea which dwell near the surface and in the very depths—from diatoms to whales, from the earliest geological periods, from North to South, from East to West. An exciting volume with "out-of-this-world" illustrations.

WESTERN BUTTERFLIES. Smith, Arthur C. 65 pages, illustrated (part colored), indexed. (Sunset Junior Book) Lane Book Co., Menlo Park, Cal. (distributed in the East by J. B. Lippincott Co., Philadelphia, Pa.) 1961. $2.95

Some of the butterflies mentioned are also found in the East. The table at the end of the book clearly indicates the range as well as the flight season and the plants on which the larvae feed. Well illustrated in color. A captivating title for butterfly hobbyists.

FOLKLORE AND SYMBOLISM OF FLOWERS, PLANTS AND TREES. Lehner, Ernst and Johanna. 128 pages, illustrated. Tudor Publishing Co., New York. 1960. $4.75.

This book is divided into five sections. Treated in the first three sections are: 1) Sacred Plants; 2) Flower Lore and Legend; 3) Strange and Wondrous Plants; and these plants are arranged in alphabetical order by common name. The Flower Calendar contains the seasons, traditional English flowers of the month, Chinese flower calendar, and Japanese flower calendar. The last section—The Language of Flowers—lists several hundred plants in alphabetical order, by common names, noting their sentiment and symbolism for Occidental, Islamic, and Oriental peoples.

The author, Max Lehner, is known as a compiler of symbols. This subject he seems to know well. Unfortunately, his knowledge of botany is not comparable. The black and white illustrations, mainly reproductions of woodcuts from sixteenth to eighteenth century herbals, are exquisite; but, alas, the text is taken almost verbatim from the works that carried the illustrations. Many of the herbalists and historians quoted, especially Pliny, are known to be unreliable. As a result, the factual information that we seek in a work of this kind, such as proper spelling, identification, correct scientific binomial, origin, history, and use of plants is erroneous in the light of today's knowledge. For instance: the ancient silphium plant *(Ferula narthex)* is not only misspelled *(Sylphium)* but we are told that it doesn't exist any more. In fact this is a close relative of asafoetida and a very prolific weed in north Africa today. Arborvitae (tree of life) is the name of a *Thuja* native to the American Pacific Coast and some islands of the Pacific Ocean. It could not have been known to the people of Asia Minor in Biblical times. None of the species today recognized as possibly being the "crown of thorns" is mentioned. Most of the plants cited were not known in the Holy Land during the first century. The pomegranate (one of Lehner's three blessed fruits) is not listed in the table of contents. It was brought to China from Samara-

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kand, a city of Asiatic Russia, and not from Kabul in Afghanistan. *Persea* is a genus of plants which are members of the *Lauraceae*. Forty-nine of the fifty known species are native to Latin America. The other plants of this genus are native to the Canary, Madeira, and Azores islands. The best-known species is the avocado *(Persea americana)*. *Balanites aegyptica* or betu is not a *Persea,* but a member of the caltrop family or *Zygophyllaceae*. Shamrock can be any one of four different plants with clover-like leaflets. The Japanese flower of the month of August could not possibly be a "hill crest" with a moon. It is iris, rose moss, or morning-glory depending upon locality, tradition, and time in history. The book does not list American Birthday Flowers or American Flowers of the Month.

It is realized that the sentiment and symbolism for all known species cannot possibly be mentioned in such a small volume; but when several hundred are listed and such favorites as angelica, baobab, barley, basil, bittersweet, bulrush, camphor, Christmas-rose, cornel cherry, dittany, elm, flax, gourd, henna, hyssop, monkshood, parsley, potato, radish, stock, wheat, wormwood, and yarrow are missing, there are inexcusable gaps.

JOHN ASCH
NEW YORK, N. Y.

FLOWER PAINTING, ITS ART AND TECHNIQUE. Zichy, Countess. 112 pages, illustrated in color and monochrome. Watson-Guptill Publications, Inc., New York. 1961. $9.75.

Countess Zichy has written a splendid book which would-be flower painters should find most helpful and encouraging. And there are numerous points which professional painters will find useful, too. Illustrated step-by-step demonstrations show the evolution of a picture from the flower arrangement as a still life set up to a finished oil painting. One thing which these demonstrations show very nicely is that one indeed does not copy the model before him.

Notes are included on framing and on the handling of watercolor, pastel, and cassein.

Among the seven color plates there are four full-page reproductions of Countess Zichy's paintings.

CHARLES C. CLARE, JR.

AMERICAN ROSE ANNUAL, 1961. Gurney, James P., editor. 243 pages, illustrated, 20 color plates. American Rose Society, Columbus, 14, Ohio. $4.50.

Twenty-five articles in this yearbook span the wide interests of rose fanciers, covering such subjects as fundamentals of growing roses, use of roses in the home landscape, pest and disease control, and hybridizing. Over one hundred and eighty old roses have been rated as to quality by a special committee. Recently introduced roses are also rated, with exhaustive comments from growers across the country, in the ever-popular "Proof of the Pudding" section.

B. L. Wagenknecht of the Arnold Arboretum produces evidence that whereas the original "yellow rose of Texas" could have been either *Rosa bracteata* or *R. spinosissima,* the plants known by this name in the Southwest are either *Potentilla glandulosa* or the double-flowered *Kerria japonica.*

PAUL F. FRESE
White Plains, New York

REVIEWS OF RECENT BOTANICAL BOOKS

THE NATIVE ORCHIDS OF TRINIDAD AND TOBAGO. Schultes, Richard Evans. 275 pages, illustrated, indexed. Pergamon Press Inc., New York. 1960. $15.00.

The Native Orchids of Trinidad and Tobago, adds another volume to the flora of that area. The government has been publishing this series over some thirty years, family by family. One reads that only seven per cent of the flora is endemic to Trinidad and Tobago. The rest is in common with that of northern South America, particularly Venezuela and the Guianas, with which the islands have geological connections. There are 181 orchid species of 66 genera included, and the bulk of the book is devoted to their description. Competing for first rank with orchids in the flora are 183 species of grasses and 172 species of legumes. All other families represented in the flora have many fewer species, an interesting situation to those concerned with speciation.

The book begins with a section on general considerations of the orchid family, which is compounded of the usual botanical information and brief items of interest, the whole strongly flavored by the publications of Oakes Ames. This is not surprising. Dr. Schultes, now curator of the Botanical Museum of Harvard University, and the author of this fine book, was one of Ames' outstanding students. He points out, "The only single character that can serve to separate the *Orchidaceae* from all other families is the absence in the embryo of a root."

The next section of the book is an excellent account of the topography of the islands and the history of orchid collecting in Trinidad and Tobago. Many items of note about early orchid collections and orchid collectors are included, and one can't help wishing that similar history and short biography were available for other regions of orchid interest in the world. One enjoys, for instance, "David Lockhart served as the first Superintendent of the Botanic Gardens in Trinidad from 1818 to his death in 1846... His name was commemorated by John Lindley in the beautiful orchid-genus *Lockhartia.*" And, "Tobago is thought to be the island to which Daniel Defoe referred as Robinson Crusoe's home, and the name of the island traces back to the Karib word that has survived as our modern term 'tobacco'."

The key to the genera is strictly dichotomous, objective, and does not make use of obscure diagnostic points. It worked out well for the two or three species I ran through it. The descriptions of species are complete for the botanist and would definitely help the advanced amateur interested in more technical aspects of orchid identification. Flowering season and distribution of the orchid plants other than on these two islands is noted. The derivation of generic names is also included, an interesting departure from the usual.

(Continued on page 191)

MEMBERSHIP

We were delighted to welcome the following new members between April 1, 1961, and July 1, 1961.

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Mrs. Betty J. Shepard
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Joe J. F. Trager
Miss Helen Van Coutren
Rudolph vander Goot
Mrs. John E. Woodridge
Joseph P. Yagodzinski
Robert Yakel

*Change in Membership Classification

NEWS, NOTES and COMMENTS

Gifts to the Garden. Under the will of Mrs. George W. Perkins, a fund was set aside for charitable gifts. As Mrs. Perkins' interest in The New York Botanical Garden was of long standing, her executors selected the Garden to share in this fund to the extent of $10,000.

Gilbert H. Montague, "in memory of [his] deceased wife, Amy Angell Collier Montague, and in commemoration of [his] many friends who are or were during their lifetime interested in The New York Botanical Garden, particularly Harriet Barnes Pratt, Maud Cowham Senior, Margaret McGrath Rockefeller, Blanche Ferry Hooker, William J. Robbins, Joseph R. Swan, Charles B. Harding, Henry F. duPont, and Edwin de T. Bechtel" bequeathed to the Garden the sum of $25,000 and certain books, prints, plates, pictures, and pamphlets relating to horticulture and floriculture.

Mrs. William S. Paley presented a Roover-Lotsch labeling machine to the Horticultural Department.

Gifts to the Library. Among the sixty-three volumes bequeathed to the Garden by Gilbert H. Montague are these rare items: *Temple of Flora* by R. J. Thornton, London, 1812, in the original leather binding. (The Library has a 1799 edition); *The English Herbal, or History of Plants* by William Salmon, London, 1750. (The Library has a 1710-11 edition); *Maison Rustique or, The Countrie Farm* compiled by Charles Stevens and John Liebault and translated by Richard Surflet, London, 1600. (The Library has a 1606 edition); *Collection Precieuse et Enlumince des Flora,* two volumes, by M. Buchoz, Paris, eighteenth century; *Plantae Selectae* by Georgius Dionysius Ehret and Christophorous Jacobus Trew, Nuremberg, 1750; *English Botany;* or, *Coloured Figures of British Plants,* thirty-six volumes, by James Edward Smith, with figures by James Sowerby. London, 1814; and *Les Roses,* three volumes, after P. J. Redouté by C. A. Thory, Paris, 1828.

Mrs. Stephen G. Cutting presented Mr. Cutting's library, representing seventy-five horticultural titles, to the Garden. Mr. Cutting, a former student-gardener and an instructor in the Educational Program, died suddenly this past spring. At the time of his death he was Horticulturist at the School of Forestry Research of Yale University.

Mrs. Elliott Averett, a member of the Advisory Council, presented Volumes 5-38 of the *American Horticultural Magazine* and a number of yearbooks of the American Daffodil Society to the Library.

Oakleigh Thorne, a member of the Board of Managers, presented 191 volumes from the library of his grandmother, Mrs. Oakleigh Thorne, to the Garden. Mrs. Thorne, who died in November, 1952, at the age of eighty-seven, was a member of The New York Botanical Garden and Honorary Vice President of The Garden Club of America from 1933-52, and played a prominent part in conservation projects, especially in the redwood groves of California.

The volumes, many of which are "association" copies—presentation copies from the author to Mrs. Thorne—reflect her interest in California native flora and California gardens, in Japanese landscape gardening, in English and Italian gardening, as well as in American horticulture. Several beautifully illustrated volumes are devoted to wrought-iron work. Some of the books are duplicates of those already in the Library, but the Garden welcomes duplicates as they enable the Library to satisfy more than one request at a time for a particular book.

Three copies of *Glory of the Wayside* by Torkel Korling were presented to the Library by the publisher, Lakeside Press, and a folio of flower plates in color was presented by the Container Corporation of America.

Elected to Board of Managers. Mrs. Arthur Hays Sulzberger and Michael Rapuano have been elected to the Board of Managers of The

New York Botanical Garden.

Mrs. Sulzberger, well-known for her civic and educational interests, is a trustee of Barnard College, her alma mater, and the University of Chattanooga, where she received a doctorate of law. She also serves on the Board of Governors of Hebrew Union College and is Vice President of the Board of Directors of the Girl Scout Council of Greater New York, Inc. Mrs. Sulzberger is a trustee of the Association of American Indian Affairs and Chairman of the Board of the Park Association of New York City, Inc.

Michael Rapuano, one of the country's leading landscape architects, is President of the American Academy in Rome and was appointed to the Commission of Fine Arts in Washington; D. C., by President Eisenhower in 1958. He is a Fellow of the American Society of Landscape Architects, an associate of the National Academy of Design, a member of the National Institute of Arts and Letters, and served on the Art Commission of the City of New York for many years. As a partner of Clarke and Rapuano, consulting engineers and landscape architects, he has been responsible for large projects across the country and in Canada, including highway and parkway systems, urban renewals, public parks, and industrial landscaping. Mr. Rapuano acts as consultant for the Philadelphia City Planning Commission and a number of universities, including Princeton, Vanderbilt, Lehigh, Wesleyan, and Indiana.

Activities of the Director and Staff. Within the past few months, Dr. William C. Steere, Director, attended the fiftieth anniversary of The New York Public Library, New York City, celebrated by a re-dedication of its quarters and an academic procession and luncheon; a meeting in Washington, D. C., of the Special Facilities Panel of the National Science Foundation; a meeting, also in Washington, D. C., to plan for a conference of Latin-American biological editors. He also visited the Mountain Lake Biological Station of the University of Virginia. Dr. Steere spent five weeks in Alaska in field work on mosses, under a grant from the Arctic Institute of North America. He was stationed at Point Barrow. Dr. Steere presented a paper on "Patterns of Geographical Distribution of Alaskan Bryophytes" at the Tenth Pacific Science Congress held in Honolulu, Hawaii.

Dr. Pierre Dansereau, returned the latter part of September from New Zealand, where he had been engaged in field work for the past four months, to assume his responsibilities as Assistant Director (Botany). Enroute from New Zealand, he stopped at Honolulu, Hawaii, where he attended the Tenth Pacific Science Congress.

T. H. Everett, Assistant Director (Horticulture) and Senior Curator of Education, Elizabeth Hall, Sarah Gildersleeve Fife Research Librarian, Dr. Julian A. Steyermark of the *Instituto Botánico* of Caracas, Venezuela, and Frank P. Knight, Director of the Royal Horticultural Society's Gardens, at Wisley, England, were guests of the Hon. Thomas C. Desmond and Mrs. Desmond at their home in Newburgh, New York. Dr. Steyermark and Mr Knight appreciated this opportunity of viewing the fine specimens in the Desmond Arboretum. Mr. Desmond is a member of the Board of Managers of The New York Botanical Garden.

Mr. Everett and Vincent Rampino, Superintendent of Buildings and Grounds, visited the Missouri Botanical Garden at St. Louis, Missouri, and Garfield Park and Lincoln Park in Chicago, Illinois. Mr. Rampino later visited the rose garden at Hershey, the rose nursery of Conard-Pyle Co., at West Grove, and Longwood Gardens at Kennett Square, all in Pennsylvania.

Miss Hall guided thirty-nine members of the Garden Club of Englewood, New Jersey, on a tour of the Garden; lectured on herbs before the Pound Ridge Garden Club at a meeting held at the home of Mrs. Mortimer J. Fox, Mt. Kisco, New York; attended the four-day activities of the Herb Society of America, visiting herb gardens on Long Island and in Westchester County, New York, and lecturing on herbs and books at the herb dinner held at the Lawrence (Long Island) Beach Club.

Dr. Bassett Maguire, Head Curator and Coordinator of Tropical Botany, attended the F A O Conference held in Rome, Italy, July 10-20, 1961. The object of this conference was to promote international cooperation in plant introduction through botanical gardens and institutions interested in exploration and taxonomic work. Dr. Maguire and Mrs. Maguire departed August 15, 1961, for six weeks in British Guiana.

Dr. Arthur Cronquist, Curator, and Dr. Richard M. Klein, Alfred H. Caspary Curator, presented a paper on "Porphyrins in Evolution" before the American Society of Plant Taxonomists during the meetings of the American Institute of Biological Sciences at Purdue University, Lafayette, Indiana, August 27-31, 1961. Dr. Klein also moderated the symposium on "Differentiation in Cell Cultures" for the Botanical Society of America during these A. I. B. S. meetings.

Dr. David J. Rogers, Curator of Economic Botany, attended a symposium on communications in science in Washington, D. C., June 19 to July 1, 1961, at the invitation of the American Institute of Biological Sciences.

Dr. Clark T. Rogerson, Curator of the Cryptogamic Herbarium, attended the Charles Horton Peck foray at Allegheny State Park in western New York State. He collected specimens of the order Hypocreales at Highlands Bilological Station in Highlands, North Carolina, in July and August, and attended the meetings of the American Institute of Biological Sciences held at Purdue University, Lafayette, Indiana, the latter part of that month.

Dr. Ronald Petersen worked in Dr. Rogerson's laboratory for seven weeks the early part of this summer. He received his Ph. D. from Columbia University on June 6, 1961: his doctorate thesis was entitled "The Aquatic Hyphomycetes of Eastern North America." Dr. Petersen spent the latter part of the summer at Highlands Biological Station in Highlands, North Carolina, collecting members of the *Clavariaceae*, or coral fungi, under a grant from the National Science Foundation.

Dr. Alma Barksdale, Research Associate, returned to the Research Laboratory on August 8, 1961, from Japan where she had spent the past year in collecting and studying water molds from Japanese lakes. Dr. Barksdale's headquarters were in the Department of Botany, Kyoto University.

Dr. Howard Irwin, Research Associate, left for Amapá, Brazil, in late June. He was joined in July by George Irvine and Robert King, graduate students, for field work in that area. Mr. King, however, returned to this country because of illness.

Frank C. MacKeever, Custodian of the Herbarium, spent two weeks in plant collecting on Nantucket Island. Mr. MacKeever believes he has found three species new to Nantucket Island, two new to Martha's Vineyard.

Louis P. Politi, Horticulturist, attended a

Victoria cruziana was first grown at The New York Botanical Garden in 1936, in the then recently remodeled tropical house of the Conservatory. The plant, which was placed in the indoor pool in mid-May, grew rapidly and flowered in early August.

The late William Tricker of water-lily fame introduced *V. cruziana* in 1894. It is a native of the Paraná River and its tributaries in Paraguay. This species has huge, floating leaves which are two to four-feet wide, not as large, however, as the leaves of *V. regia*, which are sometimes as much as six feet across. *V. cruziana* is hardier than *V. regia* and can be grown in outdoor pools if the temperature of the water is not less than 75°

The Garden grew *V. cruziana* this past summer in the pool in House 10 of the Conservatory and in the pool in the Conservatory Courtyard. Both specimens flowered and attracted considerable attention.

meeting of the American Rhododendron Society, held on the former W. R. Coe estate at Oyster Bay, Long Island. This estate is now an adjunct of the Long Island Technical and Agricultural Institute at Farmingdale. Mr. Politi sent trusses of rhododendrons to the rhododendron show held in the Trailside Museum of Watchung Reservation, Union County, New Jersey. Dr. Harold N. Moldenke, Director of the Museum and a former staff member of The New York Botanical Garden, was most appreciative of this cooperation.

Dorothy Ebel Hansell, Editor of *The Garden Journal,* was re-elected director of the American Rock Garden Society, and selected to be a judge of the photo contest being sponsored by Old Westbury Gardens. Mrs. Hansell will edit the Proceedings of the Sixteenth Annual American Horticultural Congress to be held in Northhampton, Massachusetts, October 25-27, 1961.

A new Genus, *Maguiriothamnus*. Dr. Julian A. Steyermark's research on tropical members of the *Rubiaceae* began with the genus *Gleasonia,* endemic to the sandstone table mountains of Venezuela. This summer he dedicated to Dr. Bassett Maguire a new genus that he isolated and named *Maguiriothamnus* in his honor. Dr. Steyermark returned to the *Instituto Botánico* in Caracas, Venezuela, after spending several months in research on Guayana members of the *Rubiaceae* collected by expeditions of The New York Botanical Garden.

The Herb Society of America held a four-day meeting in the New York area during the latter part of June, 1961. They visited the Herb Garden of The New York Botanical Garden on June 22. Then, joined by Mr. Everett, Miss Hall, Mr. Politi, and Miss McSweeney, Assistant to the Horticulturist, they visited the herb gardens of Mrs. Mortimer J. Fox at Mt. Kisco and Mrs. Oliver Capen at Bedford, New York.

Visitors to the Garden. During recent months the following have visited the New York Botanical Garden:

Dr. Roberta Ma, U. S. Department of Agriculture, Washington, D. C.

Frank Knight, Director, Royal Horticultural Society's Gardens, Wisley, England.

Dr. B. M. Johri, University of Delhi, Delhi, India.

Prof. John Purseglove, Dean of the School of Agriculture and Head of the Department of Botany, Trinidad.

Stanley Smith, Curator of Herbarium, New York State Museum, Albany, N. Y.

C. Weisel, Pullman, Washington.

Mrs. S. Bird, Greensboro, N. C.

Dr. A. L. Martinez, Bureau of Plant Industry, Manila, Philippines.

Dr. E. J. Smith, Dept. of Medicine, College of Physicians and Surgeons, Columbia University, New York, N. Y.

American Rose Foundation. Dr. Cynthia Westcott, Chairman of the Research Committee, reported on the grant of $3,000 to the Oregon Agricultural Experiment Station for a fundamental study of powdery mildew on roses, including an evaluation of the susceptibility of rose varieties and the testing of new fungicides and systemic chemicals for the control of mildew, rust, and blackspot. Initiated in July, 1959, for a period of three years, the grant covers the salary of a graduate research assistant, labor, supplies, and travel.

The Foundation contributes $1,000 annually for pesticide tests on roses by the United States Department of Agriculture at Beltsville, Maryland, under the direction of Dr. Floyd Smith. In cooperation with Conard-Pyle Company, large-scale field tests will be conducted for the control of thrips at the nursery in West Grove, Pennsylvania.

The Foundation contributes another $1,000 annually to the United States Department of Agriculture for a long-time period project in rose breeding.

The rose breeding program at Iowa State College has been extended in effect from 1955 to 1960, at $500 a year. Dr. Griffith Buck's part of the program is to breed extremely hardy roses that will give repeat bloom and to develop disease-resistant understock, with Dr. Lyle cooperating in field trials.

The Sixteenth Annual American Horticultural Congress will be held in Northampton, Massachusetts, October 25-28, 1961, with headquarters at the Northampton Hotel.

Registration will be at the hotel during the afternoon of October 25. The afternoon and evening have been reserved for renewing acquaintances and making new ones in a relaxed atmosphere. Thursday and Friday will be devoted to meetings, luncheons, tours, and dinners. Seven outstanding speakers will gear their talks to the general theme of "Horticultural Advances to Aid the Gardener." Dr. William C. Steere, Director of The New York Botanical Garden, will reveal how "Science Lends a Hand to the Busy Gardener."

The Smith College Botanic Garden will be on one of the tours; here is assembled the best collection of rock garden plants in New England. Two important commercial greenhouse establishments will also be visited, as will the Chrysanthemum Show staged by the horticultural students of the University of Massachusetts at Amherst.

Congress attendants will be interested in the Arcadia Wild Life Preserve, a large area administered by the Massachusetts Audubon Society where over two hundred species of birds have been recorded, and in the privately endowed park on the outskirts of Northampton. A former farm, given to the City in 1928 by Mrs. Fannie Burr in memory of her husband, Frank Newhall Cooke, has been developed into a very popular park and recreation center with funds provided by the donor. Funds for its upkeep are provided by a trust fund set up solely for this purpose so that no funds are required from tax sources—a plan all too rare in the parks of America.

Progress in the Synthesis of R N A. Dr. Jerard Hurwitz, of New York University Medical Center, described the synthesis, in a test tube, of the basic chemical that directs the making of proteins in all living things. Dr. Hurwitz presented his paper on June 7, 1961, at

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Cold Spring Harbor, Long Island, at the annual symposium on quantative biology sponsored by the Biological Laboratory of the Long Island Biological Association.

The chemical is a form of ribonucleic acid, known as RNA, which has recently been found to serve as the transmitter of information in deoxyribonucleic acid or DNA. the substance which controls heredity.

Dr. Hurwitz's accomplishment was compared by scientists at the symposium to the studies of DNA by Dr. Arthur Kornberg and his associates at Stanford University. Dr. Kornberg's work was mentioned in the article, "The Gene—1960 Model," in the July-August issue of *The Garden Journal*.

Dr. Hurwitz, a brother of Mrs. Sylvia Schulman, who is secretary to the Editor of *The Garden Journal*, presented a paper at the International Biochemical Congress in Moscow, U. S. S. R., August 10-17, 1961.

Flower Show School, Course I, of the Ninth District of the Federated Garden Clubs of New York State, Inc., will be held October 4, 5, and 6, 1961, at Memorial Methodist Church, White Plains, New York. Mrs. Milton A. Hescock, who will instruct in flower show practice, is a National Council accredited instructor and judge, a life member of the State Federation, a past chairman of several flower show schools, and a past president of the Garden Club of Mamaroneck, New York.

Dr. Robert E. Lee, Associate Professor of Floriculture at Cornell University, will teach basic horticulture. He has written several bulletins published by the University and is coauthor of *Contemporary Perennials* by Cumming and Lee, published by Macmillan Co. He is accredited by the National Council of Federated Garden Clubs to teach Courses I-V.

Mrs. Loren R. Dodson of Old Lyme, Connecticut, and Naples, Florida, will teach principles of art and types of design in flower arrangement. She is the author of *An Easy Guide to Color for Flower Arrangers,* a National Council accredited judge, and a well-known flower arranger and lecturer. In April 1950 Mrs. Dodson organized and presented under her direction the first course of the Flower Show School given in the Ninth District. Mrs. William F. Frank of New Rochelle, New York, is the Flower Show School Chairman; Mrs. Charles Hoffman, Scarsdale, New York, is the Honorary Advisor. Further details may be had by writing Mrs. Arthur G. Steinmetz, Publicity Chairman, 125 Shore Drive, Port Chester, New York, for the show brochure.

LETTERS TO THE EDITOR

Your mention of the American Iris Society in the May-June issue of *The Garden Journal* interested me. When I lived in Pelham, New York, 1898-1915, I had a large collection—about thirty varieties then called "German" iris. Nurseries were scarce in those days. Some of my iris came from Dr. Nathaniel Lord Britton.

Since the death of Richard Britton, Dr. Britton's brother, I believe I am the last surviving relative. Our mothers were cousins, and the families were intimate on Staten Island.

I can't raise beautiful iris or other northern flowers here. Temperate-zone horticulture is rather an aggravation in the subtropics.

Perhaps you may also be interested to learn how we, my sister and I, got a large collection of hardy perennials back in 1898.

George W. Park, seedsman of La Park (?) Pennsylvania, used to publish *Park's Floral Guide,* a modest little magazine which evidently reached farm households pretty thoroughly throughout the country in the 1880's and 1890's. As I recall, it was ten cents a year, twenty-five cents for three years. It had a tremendous circulation and, as I remember, carried no advertisements except of flowers.

It carried a column of exchanges, and we put in an advertisement to exchange begonias and other house plants for hardy perennials. We had just moved to the country from Harlem, New York City, where we had grown nice house plants. Our little advertisement had good response—we received answers from all over the country, Florida to Canada, and we quickly acquired a very large collection of all sorts of old-fashioned flowers for our new garden. I remember getting iris, bleeding-heart, phlox, rocket, valerian, peonies, spiraea, honesty. After sixty-three years, I've forgotten the rest.

Yes! It's true that nurseries were not common in those days, and money was not plentiful, but within a few years we had a good garden.

Mr. Park's sons still carry on the seed business—it's now located in South Carolina. They were pleased to hear from me several years ago when I wrote to tell them of the success I had had because of their father's magazine.

Thank you for inquiring about the book on cycads—I have a collection of over forty species, and want the book for reference. I have Chamberlain's *The Living Cycads,* but this new book is said to be more complete.

LAWRENCE M. SIMONSON, M.D.
Lantana, Florida

I do want to thank Dr. Steere and the staff of The New York Botanical Garden for all they did for the American Iris Society meeting on May 26, 1961. As a charter member and for many years a director, I remember the real entente between the A. I. S. and the Garden. As the chairman of all the A. I. S. test gardens for a long time, I know that hundreds, in fact, thousands of plants went out from the test garden at The New York Botanical Garden to establish and enlarge other A. I. S. test gardens. The one at Ames, Iowa, was actually a large and very complete one in two years from the divisions sent from here. This included all that

Below. Dr. John C. Wister, Director of the Arthur Hoyt Scott Horticultural Foundation of Swarthmore College, Mrs. Ethel Anson S. Peckham, and Dr. Henry A. Gleason, Curator Emeritus of The New York Botanical Garden, met at the Garden on May 26, 1961. Right. Mrs. Peckham cuts the birthday cake at the forty-first anniversary of the founding of the American Iris Society at the Garden. Dr. William C. Steere, Director, stands at right.

was available from Dr. Small's collections and all that could be spared from the borders and rock garden. Many extra catalogues also went to Ames.

I should have mentioned John Borin as my top gardening help in everything that was dug and planted whether irises, narcissi, or any other bulbs. [Mr. Borin is now the foreman of the Conservatory.]

It was really wonderful to see how, under all the difficulties and complications of the "Reconstruction," everybody flew around and did everything to be ready in time today in the best possible way. The women, the men, all of them, and with so many interruptions and amid such banging by the contractors' workmen.

It was such a pleasure to see Dr. Gleason again, who always turned in and helped me in any emergency. I couldn't help thinking that Dr. and Mrs. Britton, Dr. Dodge, Dr. Small, Dr. Barnhart, Dr. Harper, and Dr. Stout would have appreciated what you all were doing. The best parts of my long life have been with plants and the people connected with them whether botanists, horticulturists, conservationists, ornithologists, mycologists, not to forget the researchers, the librarians, the geologists.

ETHEL ANSON S. PECKHAM
Sloatsburg, New York

Would like you to know I won a first in our Garden Club of Lawrence flower show with the 'Texas Gold' parrot tulips you sent last year. I beat out quite a few older excellent gardeners whose tulips weren't anywhere near the size and beauty of mine. Have recommended you to several members of our club.

MRS. MARTIN HORNER
Lawrence, Long Island

BOOK REVIEWS (Continued from page 186)

Although the Trinidad-Tobago countryside is well described in the introduction, it is too bad more information on the specific growing conditions of different species was not included. Not only would it have been interesting to study, but the book would have greater value for the amateur and horticulturist if it covered more ecological material.

There are a number of fine illustrations, some of which have not been published before. But it is a little disappointing to find that many have been used in other publications with which the Ames Orchid Herbarium has been associated. One slip-up is that the close-up of *Stelis muscifera* opposite page 70 is not that, but the same close-up of *Pleurothallis diffusa* found opposite page 78.

Generally speaking, the book is a detailed, complete, and thorough treatment of the orchids of Trinidad and Tobago. It is a very careful work, can be recommended without hesitation, and will be an excellent source of information for botanists and horticulturists for years to come.

CARL L. WITHNER
Department of Biology
Brooklyn College, and
Curator, Orchid Collection
Brooklyn Botanic Garden

VISTAS IN BOTANY. Turrill, W. B., Ed. 547 pages, illustrated, indexed. Pergamon Press, Inc., New York, N. Y. 1959. $17.50.

The two hundred years of the Royal Botanic Gardens at Kew are appropriately commemorated by a volume of "vistas"—a title that recalls the lovely vistas along avenues of fine trees well known to visitors in those gardens. Moreover, with the rapid widening and deepening of botany in all its specialities, with the explosion of botanical publication, some sort of view over the whole region is (as B. L. T. used to say) "essential if not necessary." In planning and editing this book, Dr. Turrill, formerly keeper of the herbarium at Kew, tried to include every major aspect of botany. Taxonomy has been the major preoccupation at Kew these two hundred years, but the opening of the Jodrell laboratory in 1876 brought morphology, anatomy, and other disciplines into the picture; present plans include physiology and cytogenetics. Accordingly, we find chapters here on taxonony, anatomy, biochemistry, ecology, plant sociology and geography, paleobotany, physiology, cytology, evolution, and on the major groups of plants including even bacteria and viruses. A useful list of references is appended to each chapter.

Many of the writers of these chapters, however, direct their specialties to the uses of taxonomy; this is evident, for instance, in C. R. Metcalfe's treatment of plant anatomy. Even the biochemist, E. C. Bate-Smith of Cambridge, discusses the chemical identities of species and their bearing on evolution. In fact, one may say that these vistas demonstrate that taxonomy has emerged from the herbarium and has summoned all the other botanologies to its aid.

The chapter on cytology by D. G. Catcheside of Birmingham is purely descriptive. In a way it serves as introduction to G. L. Stebbins' discussion of evolution, which includes our various sources of information and the processes involved —mutation, hybridization, polyploidy, etc.—all presented with great clarity and a refreshing lack of speculation.

The several chapters on the groups of plants—from viruses to gymnosperms—are vistas as different, naturally, as the plants that line them. But the discussions are largely devoted to history and classification. It is unfortunate that the angiosperms do not have a chapter to themselves, but are considered as sufficiently treated by H. J. Lam of Leiden in his chapter on "Taxonomy: general principles and angiosperms." We are thus not brought up to date on the morphology of this group. Dr. Lam is much concerned with the philosophy and terminology of taxonomy, but gives little attention to the modern cytological and genetic attack. Though sceptical of all conclusions on phylogeny not supported by fossils, Lam himself indulges in considerable phylogenetic speculation.

Three chapters give a comprehensive view over floristics and ecology. Sir E. J. Salisbury, former Director of Kew, emphasizes the complexity of ecological factors, our lack of exact information on many of them, and the misleading effects of considering isolated agencies. Dr. J. Braun-Blanquet continues with plant sociology (the only chapter not in English), reviewing the methods of description, analysis, and classification of the units of vegetation (with many diagrams). Dr. Turrill writes on plant geography, its history and its modern concepts,

BOOKLETS

Catalog of Hardy Trees and Shrubs, **a list of the woody plants grown outdoors at the Garden in 1942. Illus. Price 75¢ per copy.**

Hardy Ferns and Their Culture. **Illus. Price 25¢ per copy.**

Flora of the Unicorn Tapestries. **Illus. Price 25¢ per copy.**

Food and Drug Plants of the North American Indians. **Price 25¢ per copy.**

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Plants of the Holy Scriptures. **Price 25¢ per copy.**

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Also reprints of well-illustrated, step-by-step articles on different garden techniques, written and photographed by T. H. Everett, Assistant Director (Horticulture): "Lawn Verges," "How to Force Dutch Bulbs" (in the home), "Some Sources of Humus," "Tree Pruning Pointers," "Sowing Seeds in Flats," "How to Transplant," "Some Fall Gardening Work" (i.e. heeling in, root cuttings, bulbs in pebbles), "Winter Protection of Plants."

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with a review of the vegetational realms and regions.

The last chapter is an account of plant physiology by F. W. Went, the brevity of which perhaps testifies to the lack of this particular vista in modern taxonomy.

In spite of obvious gaps, this is a very useful view over botany, both historical and descriptive, for the teacher and for the researcher who would like to keep up with other specialties than his own.

H. W. Rickett

THE PINEAPPLE. J. L. Collins. xvii + 294 pages illustrated, bibliography, indexed. Interscience Publishers, Inc., New York, 1960. $9.75.

The Pineapple follows the general pattern of other books in the World Crop Series, divided into three parts: Botany, Cultivation, and Utilization. The author is an outstanding authority on the pineapple, having spent most of his career in the scientific study of this tropical crop, largely in Hawaii.

The name pineapple usually refers to *Ananas comosus,* except in those countries where related species, and the genus *Pseudánanas,* are native. Though this fruit was apparently used by the native Indians of tropical America for centuries, it did not become known to European civilizations until the sixteenth century, and became important as a food crop only in the twentieth century when a Hawaiian engineer developed a rapid mechanical means of pealing and preparing the fruit for canning. There was considerable interest in the fruit in Europe in the eighteenth and nineteenth centuries; many noblemen raised the pineapple in glasshouses as a curiosity. Indeed, the most generally used variety, the Cayenne, became well known and was distributed from the glasshouses of Versailles.

The point or points of origin of the pineapple have not been pinpointed with any exactitude, no more that that of any other modern cultivated plants. Some concur in the opinion that the fruit originated in southern or south-central Brazil.

The history, the origin, the botany, and other aspects of the scientific study of this member of the *Bromeliaceae* are very well written. The author has a pleasing, open style which enhances the fascinating story of the plant. The development of the multiple fruit (a botanical term) is very interesting and offers a tool for students interested in morphological differentiation. The description is clear and, although the reviewer is not a specialist in this group, seems accurate in interpretation.

Under "cultural methods" are models for tropical agricultural procedures. Many advanced techniques of intensive agricultural production are employed in Hawaiian plantations—strip-paper mulching, soil fumigation, foliar spraying, and so on. Differing conditions for the eleven major-producing regions of the world are described. One minor-producing area in the Azores is discussed because of its unusual methods.

In Part III, Utilization, details of processing fresh and preserved fruit show the same remarkable integration as was shown in the chapters on cultivation. In order to utilize the greatest amount of the fruit, its parts have been studied intensively for various types of products. One section, prepared by R. M. Heinicke, deals with by-products of the pineapple plant.

David J. Rogers

REGIONS, RESOURCES, AND ECONOMIC GROWTH. Perloff, Harvey S., E. S. Dunn, Jr., E. E. Lampard, and R. F. Muth. 716 pages, illustrated, indexed. The John Hopkins Press, Baltimore, Md. 1960. $12.00.

One finds little direct discussion of plants in this volume, a detailed economic analysis of natural resources in the United States. The authors are economists or historians, and their concern is that of the relations of all our natural resources with the historical development of the country. They trace the growth and redistribution of population, productive activities, and personal income that developed between 1870 and 1910 (Chapters 1-9). Then in Chapters 10-18 regional economic developments from 1870-1950 are discussed. Chapters 19-26 follow the regional distribution of economic activities in the United States, 1939-1954. The last set of chapters, 27-34, discusses variations in levels and rates of growth of per capita income.

A comprehensive statistical index, giving source notes, tabular material on labor force by states, value of extractive resources, and so on, closes this scholarly book.

David J. Rogers

ADVANCES IN PEST CONTROL RESEARCH. Metcalf, R. L., Ed., Vol. 4, 347 pages illustrated, indexed, bibliography. Interscience Publishers, Inc., New York, N. Y. 1961. $12.50.

This is fourth in a series designed to stimulate new lines of research, and to be a continuing reference work for the research worker, the teacher, and the student in the field of pest control. Among the subjects treated are: applied insect pathology, aquatic plant control, and chemical control of insect pests of domestic animals. Nearly one hundred pages are devoted to a digest of the available information on the insecticide malathion, with 658 references in the bibliography.

P. P. Pirone

THE USE OF CHEMICALS IN SOUTHERN FORESTS. McDermid, Robert W., Ed., 152 pages, illustrated. Louisiana State University Press, Baton Rouge, La. $4.00.

Three phases of forest management—fertilization, use of chemical weed killers, and use of fungicides and insecticides—are treated in considerable detail in these papers presented at the Ninth Annual Forestry Symposium at Louisiana State University. One of the most interesting chapters discusses legal problems connected with widespread application of such chemicals as 2,4-D and 2,4-5T. This is a book for foresters and closely related professions.

P. P. Pirone

HERBICIDES AND THE SOIL. Woodford, E. K., and G. R. Sagar, Editors. 88 pages, illustrated. Blackwell Scientific Publications, Oxford, England. 1960. $3.50.

This small, paper-bound book carries four papers presented at the second symposium organized by the British Weed Control Council: Microbial breakdown of herbicides in soil, effect

of herbicides on soil micro-organisms, physico-chemical aspects of the availability of herbicides in soils, and the persistence of some important herbicides in the soil.

P. P. PIRONE

THE MOLDS AND MAN. Christensen, Clyde M. 2nd ed., revised. 238 pages, 14 plates. University of Minnesota Press, Minneapolis, Minn. 1961. Paper $1.75; cloth $4.75.

Dr. Christensen's introduction to the fungi continues to be the best of those written in a popular style. In the revised edition the discussion on fungi in foods and building materials has been brought up-to-date. A chapter on experiments with fungi has been added. Unfortunately, the appendix on classification of the fungi has been deleted in the revision. Ten good black and white photographic illustrations have been added. The book should have wide appeal for beginners in the study of fungi.

CLARK T. ROGERSON

MONOGRAPH OF MONOCHAETIA AND PESTALOTIA. Guba, Emil F. 342 pages, illustrated, indexed. Harvard University Press, Cambridge, Mass. 1961. $10.00.

The genera *Monochaetia* and *Pestalotia* include asexual fungi usually found on dead plant material, but which occasionally occur as plant parasites. A monograph of such groups must necessarily be technical in nature, and hence is often not attractive to the non-professional. Complete with keys to the species, host indices, synonymy, illustrations, and descriptions, Guba's monograph will serve as a valuable reference work on the group. Several minor flaws appear, chief among which is the inclusion of several species under a single choice of the key. However, differences in species is amply shown in their descriptions. Nomenclature opinion is used whenever necessary, not always to the clearest or most acceptable end. Definitely not the gardener's cup of tea, the work remains an invaluable aid to the professional mycologist.

RONALD H. PETERSEN

Two station wagons—six men in the first, five in the second—slowed down, then came to a halt across the street and looked toward our house. What could they want?

A man stepped from each car, crossed the street, entered our driveway, and stopped. I should have known what they were looking at —the tulips. And not only looking at them but measuring them and signaling the sizes to their companions in the station wagons.

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'Niphetos' was lovely, so were 'Golden Age' and 'Zwanenburg'.

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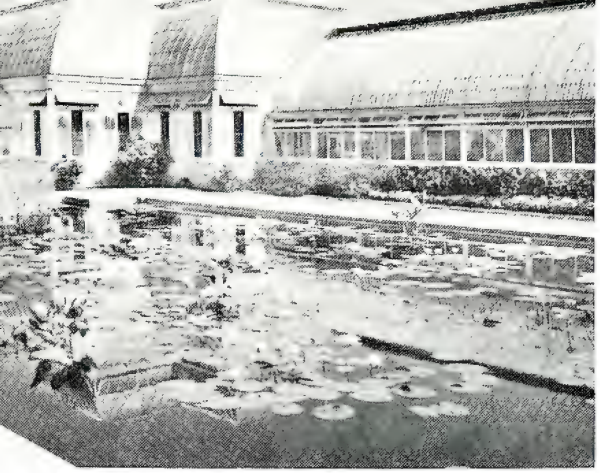

THE GARDEN JOURNAL

THE NEW YORK BOTANICAL GARDEN

DOROTHY EBEL HANSELL
Editor

CALENDAR

November 18, 1961, 3 p.m. Free Saturday Afternoon Programs resume in Lecture Hall of the Museum and Administration Building, with Mr. and Mrs. Philip Bergh giving an illustrated talk, entitled "Little Pageants of Nature, Third Edition."

December 7, 1961. Holiday House Tour, sponsored by the Volunteer Associates of The New York Botanical Garden.

December 14, 1961. Theater Benefit, "Gay Life" at the Shubert Theater, sponsored by the Volunteer Associates of The New York Botanical Garden.

December 15, 1961. Christmas Show opens in the Conservatory of The New York Botanical Garden and will extend well into January, 1962.

January 4, 11, 18, 25, 1962. Downtown Lecture Series, sponsored by the Volunteer Associates of The New York Botanical Garden.

March 10-18, 1962. International Flower Show, Coliseum, New York, N. Y.

March 11-17, 1962. Spring Flower Show, Commercial Museum, Philadelphia, Pa.

March 17-25, 1962. New England Spring Flower Show, Wonderland Park, Revere, Mass.

April 4, 1962. Members' Evening of The New York Botanical Garden, Essex House, New York, N. Y.

April 8-11, 1962. Seventh Annual Horticultural Congress, Norfolk, Va. Headquarters: The Golden Triangle Motor Hotel.

April 27-May 7, 1962. Floralies, International Horticultural Exposition under auspices of Société d' Horticulture and Jardin Populaires de France in Valenciennes, France.

May 1 and 2, 1962. "Tally-ho"—tour and show of The Garden Club of New Jersey (Bedminster-Peapack-Gladstone area).

May 14-16, 1962. Annual meeting of the Herb Society of America at Washington, D. C.; headquarters, Marriott Hotel. Hostess—The Member-at-Large Unit of the Society; Mrs. S. J. Neiburg, Paxton, Ill., Chairman.

August 31-September 8, 1962. Sixteenth International Horticultural Congress, Brussels, Belgium.

April 26-October 13, 1963. International Horticultural Exposition, Hamburg, West Germany.

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While every effort is made by the Editor to avoid errors, the ultimate responsibility for all statements rests with the authors.

CREDITS FOR ILLUSTRATIONS

We are indebted to the Display Committee, Mrs. Charles Burlingham, Chairman, for the selection of the front cover illustration—Within the Conservatory of The New York Botanical Garden by Gottscho-Schleisner, Inc.; p. 194, p. 195, top, lower left, J. Horace McFarland Co.; p. 195, lower right, Gottscho-Schleisner, Inc.; p. 196, left, J. Horace McFarland Co. upper right, Edgar L. Kline, lower right, H. v. Wall—Oregon Bulb Farm, lower right, E. N. Mitchell; pp. 198, 199, Jackson and Perkins Co.; p. 205, John Ahlhauser—Boerner Botanical Gardens; p. 206, upper, Boerner Botanical Gardens; lower, The Milwaukee Journal; p. 207, lower, p. 208, Milwaukee Co. Park Commission; pp. 209, 210, R. G. Gorton; p. 214, Gottscho-Schleisner, Inc.; p. 215, left, E. N. Mitchell; p. 215, right, p. 216, upper, pp. 217, 219, Gottscho-Schleisner, Inc.; p. 216, lower, E. N. Mitchell; p. 218, The New York Botanical Garden; pp. 220, 221, 222, Murray Wright; p. 228, E. N. Mitchell; p. 231, W. Atlee Burpee Co.; p. 232, Wee Carr Studio.

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A sale of unusual Christmas gifts and decorations will be held at one of the apartments.

There will be two sessions: in the morning from 10:30 A.M. to 1:30 P.M.; in the afternoon from 2 P.M. to 5:30 P.M.

Gracie Mansion, which will be decorated by The New York Botanical Garden, will be open to both sessions from 2:30 P.M. to 5:30 P.M.

Tickets are available from The New York Botanical Garden Downtown Office, 22 East 60th Street, New York 22, New York. For members of The Garden, $8.00; for non-members $10.00.

HISTORY AND DEVELOPMENT OF MODERN HYBRID LILIES

By FRED M. ABBEY

Mr. Abbey has long been interested in breeding lilies. He is the Manager of Gardenside Nurseries of Shelburne, Vermont, and the President of the North American Lily Society.

IT IS DIFFICULT to determine just when the development of present-day hybrid lilies began, for several are being cultivated that have been in catalogs for more than twenty years, and one at least is dated 1810. Interest in the genus *Lilium* lagged, except among a very small number of enthusiasts, and not until the introduction of *L. regale* about 1910 did it begin to quicken. For a while, this easily grown species was of absorbing interest. Eventually a few hybrids of *L. regale* were raised. In 1920 a supposed cross between it and *L. sargentiae* was named *L. princeps;* this later reverted to *L. imperiale,* the name originally applied to it by Wilson in 1920. This was followed by a fine selection, called G. C. Creelman; it resulted from a cross between *L. sargentiae* and *L. regale* that was made by Miss Isabella Preston in 1916.

With the evidence that it was possible to obtain new forms, several persons began hybridizing extensively. Before World War II, quite a bit of breeding had been done, although very few clones had been introduced. In England, crossing of the Martagon types with *L. hansonii* in the 1890's had resulted in the Backhouse Hybrids, but even as late as 1940 very small numbers of these hybrids were available. In France, M. Debras had succeeded in crossing *L. sargentiae* with *L. henryi,* the seedling first flowering in 1928; this achievement was to have considerable influence later on. In America, Tom Barry had produced a similar hybrid with *L. sulphureum* as the seed parent and *L. henryi* pollen; the cross was made in 1933. In Canada, Miss Preston, who was working with other species, sent out the Stenographer Group, some of which first flowered in 1932. This was the situation at the beginning of the 1940's. Most of the presently popular forms are therefore not over twenty years old.

Certain conclusions that I have drawn and shall state in this article are my own; also some names and dates have been taken from memory and could not be readily verified.

There appear to be six general lines along which present-day lilies have been developed. No one would dare to say which is the most important, or the first to become popular. Listing them is a matter of convenience, and so I start off with hybrids of *L. regale.* Next comes the Aurelian group, or hybrids derived from trumpet lilies that have been pollinated by *L. henryi.* For those who can grow them well, there are a number of good forms and hybrids of *L. auratum* and *L. speciosum,* more perhaps of the former than of the latter.

With the same reservation—ease of culture—I must include developments in the Martagon Group. Martagon or Turks-cap lilies have been crossed with the Korean *L. hansonii* to give hybrids that differ widely in colors, but have no marked change in the form of the flower.

The same can be said of a group usually called the Patterson Hybrids, in which changes have occurred in color, vigor, and flowering periods; but again the form of the flower has changed but little. Last and probably latest are the many fine hybrids developed from crosses made between *L. tigrinum* and *L. hollandicum,* beginning with 'Enchantment' and continuing to the recent introduction of a yellow-flowered variant of *L. tigrinum* that is giving eastern hybridizers some unusual results.

At present work is being done and results are being achieved in hybridizing both the eastern and the western native species. Beyond any doubt, a few crosses have been made that cannot be included in the above six lines. These, however, are not yet important and can be disregarded except to comment that such work should be given every encouragement. When we consider what has been attained in the past twenty years, there is every reason to expect that the next twenty years will give us much more.

A careful reading of Wilson's *Lilies of Eastern Asia,* in the light of present developments in trumpet lilies, cannot fail to impress one with the fact that these are quite closely related. It is true that *L. regale* and *L. sargentiae* differ in a number of characteristics (one bears bulbils, the other does not, for example); still when they were crossed, the latter being used as the seed parent, the very first generation produced forms intermediate between the two. These were named the Shelburne Hybrids. When *L. regale* was the seed parent, the results were less pronounced, but they would seem to prove that geographical distribution had produced in *L. regale* a very true-breeding strain. Later on, the use of *L. centifolium* (as *L. leucanthum* var. *chloraster* is known in lily circles) quickly produced varied results. As far back as 1933, a slight pink coloring was noted in seedlings of several of these strains, and eventually the lovely pink trumpets made their appearance. Yellow also became dominant with the use of a clone known as Butterfield lily, said by some to be derived from work done by Luther Burbank. The Olympic Hybrids have much *L. centifolium* blood and are characterized particularly by the magnificent pyramidal inflorescence. There are pure white, soft yellow, and soft green forms. The extra bud on the pedicel is a recent development; this bud was never found in the species.

Names that are associated with these lilies include L. N. Freimann, who first observed a pink coloring in some of the strains on the West Coast; Carleton Yerex, who noted it in some seedlings of Shelburne Hybrids that were sent to him from Gardenside Nurseries, where this color appeared shortly after and resulted in several clones of merit. Jan deGraaff's Olympic Hybrids are famous. Eric Mayell and John Shaver have also sent out fine strains. Another name, now often forgotten, is that of L. H. Abel. He com-

Lilium centifolium

bined some of the early hybrids from the best of several eastern strains and came up with the Green Mountain Hybrids. Dr. E. F. Palmer worked with the more pronounced yellow sorts—among them *L. sulphureum* and *L. sulphurgale* (which resulted from crossing *L. sulphureum* and *L. regale)*—to produce varied shades of soft yellow, one of which was named 'Galahad'. These hybrids seem close to his introductions in the Aurelian Group, but they are placed in the trumpets by those who are supposed to know their lilies.

Perhaps the Aurelian Hybrids vary in flower form more than any other group. They resulted from crosses between a trumpet parent, *L. sargentiae,* and a Turks-cap, *L. henryi,* one with curled-back petals, and the progeny may be like either parent, or intermediate. Some of the loveliest are those that have the narrow segments of *L. henryi* and are flat or curl back only at the tips. Since both parents contributed yellow as the basic color, it is not surprising that the offspring vary from intense orange through softer shades of yellow to white. If the seedlings from Tom Barry's Havemeyer lily are included in this group, the color range is extended to greenish yellows, and more recently to bicolors. There are early and late strains, some of which prolong the flowering period into September. There are widely flared trumpets, and finally there are pink-shaded Aurelians. While this group was first raised in France, much has been done with it in this country, and the name of Dr. Palmer must be placed close to the top. Carleton Yerex and Jan deGraaff have also sent out many spectacular forms. In the Midwest, Mrs. Martha Mears has done excellent work, and Edgar Kline has assembled and increased some of the best of Tom Barry's seedlings.

This is one of the most easily grown groups of lilies; it is hardy; not free from disease, but very virus-tolerant and does well even when infected; and flowers over a long period. These lilies have been used widely as a basic strain for hybridizing, and beyond any doubt are responsible for some fine forms among the trumpets.

Developments in the *L. auratum–L. speciosum* group are spectacular, but not all can be considered hybrids. As is well known, the historian Francis Parkman succeeded many years ago in raising a hybrid from a cross between these two species. It was lost, and it was not until recently that Parkman's lily was re-created in Australia and named 'Jillian Wallace'. Since then we have learned that when these two species are crossed, they produce viable seed, but the seed secretes a substance that kills the germinating seedlings in a short time. Dr. S. L. Emsweller of the United States Department of Agriculture, Beltsville, Maryland, has done most outstanding work in growing this cross, by excising the embryo and keeping it alive, under sterile conditions in test tubes and agar, until it could be put into the ground. The first of the seedlings so produced trace back to some hybrids developed by Dr. George Slate of Geneva, New York; they were called the Potomac Hybrids and immediately became popular. Further crosses of *L. speciosum,* back on *L. auratum* by *L. speciosum* forms, have given a still newer group of Potomacs, which are not only magnificent but seem to be of easy culture under eastern conditions. For the most part, the forms of *L. auratum* or hybrids of it, if they are really hybrids with *L. auratum* as the seed parent, are not of easy culture in the East; and it must be suspected that most are further crosses on the basic *L. auratum* by *L. speciosum* or else are variants only of *L. auratum.* Where they can be grown well, these two, with either their hybrids or variants, are among the most cherished of garden lilies. It is to be hoped that their susceptibility to disease will vanish with the newer forms.

L. martagon and *L. hansonii,* originally crossed in England, produced a number of fine hybrids; among some of the best are the well-known Backhouse Hybrids. Later crossings may have repeated the original ones, or may be seedlings from the original. In any case, several strains are now available. Dr. Slate has worked with these little jewels for years, and he continues to do so. In Oregon, Edgar Kline has developed his strain of Painted Ladies, and Mr. deGraaff

Lilium sargentiae

his Paisley Strain. In the East, W. C. Horsford is raising a very diverse and vigorous group, which is not yet named or introduced, and Dr. Norma E. Pfeiffer of Yonkers, New York, has a strain named Terrace City Hybrids. All of these need a little shade for best results and seem to require a heavy loam. When they are growing in the right conditions, they are most spectacular; there can be upward of sixty small and unusually colored flowers on each spike, each reaching up to six feet in height. It is to be hoped that their susceptibility to basal rot, which is distinctly a limiting factor in their culture, may be overcome. They usually escape mosaic disease.

In working to obtain lilies that would be hardy on the northern plains, Dr. C. F. Patterson of the University of Saskatchewan used *L. cernuum* with *L. willmottiae* and *L. tigrinum,* and possibly some of the Stenographer Group. From his crosses have come some of the most delightful new lilies, particularly hardy. They are mostly of the Turkscap type, as are all the parents, but the colors range from white to pink to rose, and also to yellow. They need only an extension of their flowering period, late June and well into July, to make them the most comprehensive new group available. Heat, drought, and cold do not seem to bother them. Dr. Patterson's recent death may put an end to further introductions from this source. However, others have begun working to enhance their values, and the deGraaff Harlequin Hybrids must be mentioned. At present, however, none surpass the Patterson Hybrids in their season.

Many fine lilies have resulted from crosses in which *L. tigrinum* has been used as a parent with early cup-shaped species and probably with nodding sorts as well. It is difficult to keep up with all the developments, and one might wish that there were less duplication in form and color. All are easily grown, of course, and generally are persistent, soon making fine clumps. It would be useless to attempt to select any one lot as particularly outstanding, for it is almost certain to be superseded in a very short time. Mr. deGraaff has done considerable work with *L. tigrinum.* The names of Percy Byam, Dr. Palmer, and J. C. Taylor, all of Canada, are associated with these lilies. Dr. Frank Skinner, also of Canada, has worked with a number of *Lilium* species. All these men have given us varieties of great beauty, finish, and ease of culture.

The introduction not too long ago of the yellow-flowered

Lilium sulphureum

Lilium henryi

Lilium tigrinum

Above. *Lilium martagon.*

Upper right. The Painted Lady Strain by Edgar L. Klein.

Lower right. The Paisley Strain by Jan deGraaff.

L. tigrinum stimulated further crossing on this as a parent or with its pollen on other species. The results fall in two general groups: one with upright flowers; the other with outward-facing flowers. Their colors are vivid, with a high sheen. The plants are very vigorous. Perhaps the most notable improvement is that there are often two, and sometimes three and four flowers to a pedicel, and this gives an exceptionally long period of bloom. The names of two Connecticut men, David Stone and Norman Lamb, are closely identified with these new forms.

Mention of Connecticut reminds me that Ralph Warner of that state was probably the first to raise seedlings of which one parent was the lovely pink *L. japonicum* and the other *L. auratum.* [Dr. Pfeiffer was the first to cross these two species: she crossed *L. auratum* by *L. japonicum* and published the results a couple of years before Mr. Warner reported.] This work is being continued in Oregon with the very early pink *L. rubellum* and *L. auratum.* The hybrids carry coloring quite different from the stronger colors of *L. speciosum.* Continued cross-breeding may achieve the ease of culture that they do not yet possess.

Hybridizers think first of all about producing an unusual bloom. But some of their efforts should be aimed at obtaining greater disease-resistance or virus-tolerance. Natural selection helps, for varieties that fail to do well are sure to disappear from lists. And this may happen to many of the new forms now appearing, as has happened to new forms of gladiolus, irises, and day-lilies.

Three major diseases attack lilies. First is botrytis blight, caused by the fungus *Botrytis,* which spoils foliage and blooms and is very prevalent in wet seasons or in areas where the humidity is high. Attempts have been made to breed immunity to this disease in the newer forms, but indications are that botrytis, too, is changing. The best control at the present time is a covering coat of fungicide; Bordeaux mixture is recommended, and very good results are attained by using a neutral copper dust. Both will discolor the foliage, but the latter is less noticeable. It is necessary to begin applying either remedy before the disease strikes, since it cannot be eradicated by any method.

Basal rot caused by *Fusarium* is present in most garden soils. With the excessive use of manure, it may become quite virulent and seriously weaken bulbs. Certain species and hybrids are more susceptible than others. If trouble is experienced, it is good sense to try other lilies, or at least to move the bulbs to new soil; first clean off infected scales and soak the bulbs in captan or a similar material. If properly proportioned, captan or "Tersan" can do no harm and may prevent reinfection. Soil sterilization, though recommended, is usually difficult to manage in the mixed garden border or bed.

Much has been written about the virus that produces mosaic disease, but no effective control is yet known. Some species are able to grow well even though they contain the virus, and their use in hybridizing may develop greater resistance in their progeny, or at least the ability to live with one or more of the virus strains may be passed along to forms that cannot now do so. A combination of several virus strains is usually fatal to most lilies, although *L. tigrinum* seems able to survive under any condition, another factor in the present interest in its use as a parent. But it must be remembered that growing resistant strains of lilies that are infected with a virus is a danger to the more susceptible species in the same planting. As aphids carry the virus, it is necessary to spray to prevent the spread of this pest to the lilies. Systemic insecticides do this very well.

A recent development at the Beltsville Station of the United States Department of Agriculture is of interest. Scientists there have found that newly developing scales of lilies that are known to carry the virus diseases may be

(Continued on page 224)

Olympic Hybrids by Jan deGraaff.

Lilium auratum platyphyllum rubrum in a border at The New York Botanical Garden.

THE CHRISTMAS-ROSE

By DOROTHY EBEL HANSELL

THE CHRISTMAS-ROSE is actually not a rose, but a member of the buttercup family or *Ranunculaceae;* its botanical name is *Helleborus niger.*

This hardy perennial, native of many parts of continental Europe and Asia Minor, was introduced into English gardens more than three hundred and fifty years ago—as far back as 1596, so the records indicate. Some years later it was brought to America, and occasionally large clumps are found in very old gardens.

The Christmas-rose gives an out-of-season touch to the garden, for it bears its flowers in winter when practically all hardy perennials have retired from the scene and are resting. My first sight of the Christmas-rose was on the W. G. Mather estate in Cleveland, Ohio, a number of years ago. It was a bitter cold day, with wintry blasts blowing from Lake Erie across this lake-shore estate—certainly not the kind of day I should look for flowers at my feet. Yet beneath a pleached allee of beech trees were over a hundred exquisite off-white flowers. Some had a greenish cast to their petal-like sepals, some were flushed a delicate pale pink. The prominent golden stamens and attractive palmately-divided leaves of a leathery texture added to their startling beauty.

These Christmas-roses were flourishing in a sandy loam that had been enriched with well-rotted manure and leafmold. They were given plenty of water from June to October, were shaded for half the day, and were protected from strong winds under the pleached allee.

Amateur gardeners are told that *H. niger* is sturdy and reliable and not a difficult plant to handle. However, they sometimes meet with disappointment when they try to grow it, because they may have overlooked one of the basic conditions for its successful culture. Christmas-roses must be grown in moist but well-drained, enriched sandy loam;

The Christmas-rose is arranged effectively with its own foliage in a low container.

The Christmas-rose bears its blooms above snow-covered ground.

they must be shaded for at least half the day, and preferably after mid-day; and they must be protected from strong winds. During their growing period, June to October, they must be provided with an adequate supply of moisture. They do well in a shrub border, in an open wooded area, or in a foundation planting on the east side of a house, and should be left undisturbed until they have outgrown their location. Dividing the clumps—May is the best time for this operation—and transplanting them will increase the number of plants but will reduce the number of flowers.

In planting, the divisions should be set in holes large enough so that the roots are spread out, and the eyes, or crown buds, are a half inch below ground level. When the eyes are set level with or above the ground, they are likely to dry up from spring winds or summer heat. If the divisions are placed twelve to fifteen inches apart, they will have ample room to develop and will not need to be moved for some years.

Helleborus niger is sometimes troubled by insect pests and diseases. If aphids become a nuisance, they can be controlled by spraying with a lindane or malathion insecticide. Browning of the leaves is sometimes noticeable in midsummer; this is caused by too little shade, insufficient moisture, or too shallow planting, and any one of these errors can be corrected. Black spots may appear on the leaves in late fall, if the weather is unusually cold and wet. These spots can be treated with a sulphur dust or a mild dose of one of the sprays used for black spot on roses. Crown-rot, the same disease so common with delphiniums, may attack the Christmas-rose, in which case better start with new plants in another part of the garden.

Since the sepals may be spattered during stormy weather,

clean straw, peat moss, wood chips, or a layer of dried leaves may be placed around the plants as the flower buds develop. Some gardeners put a cloche over the entire plant; others build a ventilated, glass-covered box large enough to enclose their entire planting of Christmas-roses. Any one of these methods will keep the flowers from being marred, and this is especially desirable if they are cut to be used in arrangements. They make exquisite arrangements, with just their own foliage, in low bowls. The late Miss Hester Franklin of Murray Hill, New Jersey, cut flowers generously from her plants. These had been growing on her family's place for many years and had spread to such an extent that they looked as if they had been naturalized. One year, a few days before Christmas, with several inches of crusty snow covering the ground, Miss Franklin carried a low white bowl filled with Christmas-roses and their dark evergreen leaves to the New Providence Library. The Library was then housed in an old wooden building, painted white on the outside, rather drab within. The Christmas-roses gave it life and sparkle. I can still hear the exclamations of surprise and delight as visitors came in from the cold outdoors and saw the lovely white flowers on the librarian's desk.

Selma Lagerlof has written an enchanting story about the Christmas-rose.* It tells how Robber Mother from Göeinge Forest, who had gone begging to Övid Cloister, entered the gate, although forbidden to do so, when she saw the colorful herb garden. Abbot Hans heard the confusion caused by her presence in the cloister and joined the lay brother and several monks who were trying to force her to leave.

Robber Mother said to Abbot Hans, "First, when I saw this, I thought I had never seen a prettier garden; but now I see that it can't be compared with one I know of." She was referring to the beautiful garden into which Göeinge Forest was transformed every Christmas Eve.

Abbot Hans had long wanted to witness this miracle, so he arranged with Robber Mother to have one of her children guide him and a lay brother to Robbers' Cave on Christmas Eve. There they all waited until the dark forest was suddenly illuminated.

"Then Abbot Hans saw that the snow had vanished from the ground, as if some one had removed a carpet, and the earth began to take on a green covering. Then the ferns shot up their fronds, rolled like a bishop's staff. The heather that grew on the stony hills and the bog-myrtle rooted in the ground moss dressed themselves quickly in new bloom. The moss-tufts thickened and raised themselves, and the spring blossoms shot upward their swelling buds which al-

The Christmas-rose flourishes above a mulch of leaves and against a background of evergreens.

*The Legend of The Christmas-Rose by Selma Lagerlof, translated by Vera Swanston Howard. Copyright 1910 by Selma Lagerlof. Used by permission of Doubleday and Company, Inc.

ready had a touch of color."

Abbot Hans was awed by all this beauty, but the lay brother exclaimed it could not be a miracle of God, but must have its origin in witchcraft. Immediately all the wondrous beauty vanished. "Darkness sank over the earth like a coverlet; frost came, all the growths shrivelled up . . the leaves dropped from the trees rustling like rain.' '

Abbot Hans fell upon the ground. Clasped in his hand were roots of the flower he had promised to bring back to Bishop Absalon. The lay brother planted and cared for the roots, but they gave so sign of growth. But on Christmas Eve the lay brother, thinking about Abbot Hans, walked into the garden. There he found a beautiful white flower.

"It has been named the Christmas-rose. And each year at Christmastide she sends forth from the earth her green stalks and white blossoms. . . ."

ADVENTURE IN ALASKA

The following excerpts of a letter from Dr. William C. Steere, Director of The New York Botanical Garden, to Henry de la Montagne, Assistant Director Emeritus, will interest readers of *The Garden Journal,* revealing, as it does, the vicissitudes of field work in northernmost Alaska. Dr. and Mrs. Steere spent over a month there this past summer, under a grant from the Arctic Institute of North America, working out of the Arctic Research Laboratory at Point Barrow.

"DOROTHY AND I got back to Barrow early Wednesday morning (July 26, 1961) after a week in the Brooks Range. We had planned to be away from the base from ten days to two weeks, spending about three days in each of three places. However, we had no more than arrived at Liberator Lake, which is on the northern front of the Brooks Range almost straight south from Barrow, at a latitude just below 69°, when the weather deteriorated. We encountered wind, rain, and snow in various combinations every day we were in the field. The only useful purpose of these adverse weather conditions was to ground the mosquitoes—there were hordes of them because of the wet tundra. In the absence of sand or gravel, we had to pitch our floorless tent right on the marshy tundra—a very "squishy" underfooting. With the rain beating down on our tents most of the time, even our sleeping bags were wet. What brought us back to Barrow was not this certain measure of discomfort, but the fact that our plant specimens could not be dried and were beginning to show ill effects from so long storage in plastic bags.

"We were camped on the south shore of Liberator Lake, with a one-thousand-foot ridge a half mile south of us and still higher mountains behind it. For some reason these ridges caused the most amazing turbulence with a south wind that I have ever experienced. All night, almost every night, we went through cycles of a complete lull in the wind, then, wham! came a gust of full-gale proportions which would threaten to take down our tent. Fortunately, I found a couple of empty gasoline drums to hold the most important stakes into the soggy ground and so, although our tent flapped and ballooned, it never actually left us.

"About midnight on Monday (July 24, 1961) we heard a small plane, right in the midst of the most gusty downdrafts, and rushed out to see if it was the plane that was scheduled to move us. However, we saw that it had wheels instead of floats; it had come to check on us as well as to drop some extra mosquito repellent. Because of the terrific wind, the plane could not get the drop within a mile of us, and both the repellent and the pilot's pistol, as we learned much later, went into the lake. We found out on our return to Barrow that the pilot considered himself lucky to have gotten off 'with his skin'—the plane itself had popped the paint off many rivets from the buffeting.

"The weather began to clear on Wednesday, and that night the float-plane arrived to move us to our next place of operation. However, because of the wet and spoiling specimens, we sadly decided to return to Barrow.

"The pilot had to move a couple of investigators from one camping spot to another in Howard Pass, about seventy-five miles southeast, so I went with him in order to see another area. These investigators, by the way, are graduate students of Dr. John Tedrow, the soils expert at Rutgers and an old friend of mine. I had expected to find him there, but he had been forced to return home to testify in a murder case in which, in true detective fashion, the suspect had some special sort of earth in his trouser cuffs. Moving Tedrow's graduate students took much longer than anticipated, as these small float-planes do not have much capacity, even with the seats taken out. We had expected to be back at our camp by midnight; it was 4:30 a.m., when we finally returned—and Dorothy, naturally, was quite worried. We gathered our personal gear together, got ourselves and our soggy specimens into the plane, and were back at Barrow at 7:00 a.m. This is perfectly in form for travel on the Arctic Slope—nothing is predictable. But a completely unpredictable experience is a stimulating environment for getting out of ruts and for restoring perspective.

"We are going into the field again on Sunday. The bad weather should be almost over, at least so the statistics on rainfall indicate. We hope to be back here (at Barrow) Wednesday night or Thursday morning and will spend a couple of days in drying specimens, packing, and shipping them. This trip will finish what we had planned to do on the last one. Our tents and cooking gear are still at Liberator Lake, and we shall just pick up from there. We are due to land in New York early on August 8 on the night jet flight from Seattle.

"This has been a very short summer, but extremely interesting and unexpectedly successful botanically. I keep thinking that little that is new and exciting can possibly turn up here, and yet this summer has been as rewarding as the past ones.

"The most interesting plant we collected is a little hepatic whose closest relatives are tropical and subtropical. This is a distribution pattern that I have already discovered here in previous years, and undoubtedly reflects a much warmer climate at some time in the geological past, either before the Pleistocene ice age or during one of the longer interglacial periods. Also, the Aleutian Island chain is a relatively recent development, and before it arose, the Japanese current undoubtedly circulated into the Bering Sea. The relation between geology and plant geography is a close one.' '

RECENT ENDEAVORS WITH COMPUTERS IN TAXONOMY

By DAVID J. ROGERS

Dr. Rogers is Curator of Economic Botany at The New York Botanical Garden.

SEVERAL TIMES during the past two or three years items have appeared in *The Garden Journal* indicating that I have been doing something with various types of electronic devices for the computation and correlation of botanical information. These items, given without any introduction, and only fitfully reported, may have been a bit confusing to the readers, and perhaps it is time to review this field of endeavor, telling what has happened, what the present operations are, and what may develop in the future.

It would be interesting to start with a history of the development of data-processing devices, but this is beyond the scope of this report. Suffice it to say that the idea for the devices that can handle large quantities of data (numbers, representing information) is not new, and during the past century several mechanical devices were built to carry out the same types of calculations and operations that are today no longer mechanical, but electronic in method. We still use many mechanical devices in the operations along with the electronic devices, and often it is better or cheaper to use filing cards, hand-written or typed, or cards that are notched along the edge or have holes (square or round) punched in designated spots to code certain pieces of information. All such mechanisms must be considered as nothing more than tools to relieve people of the drudgery of tedious operations, and to help jog faulty memories.

Anyone, upon a little reflection, will see that there are different levels of complexity to the devices now used in almost every facet of our life. Billing for the large magazines is done with punched cards. Life insurance companies would be deluged in paper work, unless they could record statistics in more condensed form on similar cards. But the punched card by itself is of very little use—a hole in a card means little; the hole has been designated to carry one piece of information only, such as the expiration of a subscription, how much you still owe on your automobile, the color of your eyes, your age; or, in the case of plants, whether a particular species is a tree, shrub, or herb, the color of its flowers, the shape of its leaves, and so on. What do you do with this information once you have set up a card system? I suppose some people just like to accumulate cards, like the patient who said, when he found that his doctor liked pancakes, "Oh, Doctor, I'm glad you like them too—I have trunks *full* of them!" We try to steer clear of this.

All kinds of information (and data are kinds of information) must be put into some order of relatedness to have meaning. The more information, the more difficult the job of keeping it related. Eventually, the punched card becomes cumbersome for storing information, and some more sophisticated device must be found. We have all seen TV reports of elections predicted by "electronic brains"; usually during the program the TV camera is sooner or later focused on a series of tall boxes in which reels of tape are being erratically jerked back and forth. We know that those reels carry tape on which are recorded thousands of electric impulses, each impulse more or less analogous to the hole in the punched card in that by its position on the tape (the address) it is coded for a particular piece of information. By using electronic tape instead of punched cards, much more information may be stored in a much smaller space.

As more information is stored, more possibilities for its use may be found. When certain quantities of information are stored, we may re-organize the information in many different ways to get new, or different, sets of correlations from the same information. Let's see how this might work in a botanical setting. Suppose we have a set of punched cards on which we have recorded (at specific spots on the cards) the known species of the genus *Acer* (maple), the geographic distribution of each species, the botanical characteristics for identification (lobing of the leaf, the shape and size of the winged fruits, and so on), and the uses. You may wish to know which species of maple (if any) may be found in a particular section of the country. Were this information recorded, it would be a rather simple matter to pass our cards through a sorter, coded to retrieve the information on distribution, and have those cards drop into one pile with the desired geographic distribution of the maples. Another person may ask that the cards be sorted with more than one question in mind to make rather simple correlations of information. Indeed, it is frequently useless to employ more complex machinery than the card punch, the electronic sorter, and the collator. On the last two machines, both electronic and mechanical devices aid in the operations that the two are designed to perform.

The New York Botanical Garden, thanks to a grant from the National Science Foundation, is sponsoring a very large project that uses the above devices. This project is essentially a straightforward bibliographic endeavor to record all the scientific names of plants, and will also include information on the botanists who first named the plants, the places of publication (journal, book, or other scientific publication), the dates of publication, and other useful data. This program will not attempt to identify the plants, or to do any taxonomic work. Its purpose is, as stated, to produce a catalog of and reference to the scientific names that have been applied to plants.

In this particular project, the stored information need not be recalled (or retrieved) in a very short time, because it will be a reference work to be used for organizing catalogs or indexes of information, among other purposes. These indexes will be printed, and may provide an important adjunct to botanical research of many kinds, including taxonomy, ecology, physiology, and economic botany.

However, there are problems in systematic botany (taxonomy), as in most other branches of science, in which

the punched card, the sorter, and the collator are too slow for the most efficient operations. In the problems mentioned, to be discussed in more detail later, any particular bit of information may be needed almost instantaneously; for this purpose, electric circuits are important, and the information must be transmissible over these circuits. Therefore, a hole in a card becomes an intolerable hindrance to speed, and here the electronic tapes come into play. There are other ways in which information may be stored electronically, and from which the information may be recalled even more rapidly than from the tapes. With these techniques, some particular bit of information may be recalled in a very small fraction of a second.

The history of the electronic computer is another fascinating story, but again, this is not the place to develop it. We know that the pressing logistics problems of World War II pushed the development of the computers much more rapidly than would possibly have happened under peace-time conditions. Their development has been rapid, and today our whole economy might grind to a halt if we suddenly had to remove the computers from the telephone companies, the large heavy industries, and from the financial centers of the United States. Much of our science would be impossible without the computers to store and recall information that could never be incorporated into the mind of an individual. This statement is truest in the physical sciences, particularly in the sciences dealing with space.

Slowly the computers and their associated rapid printers are finding their way into the biological sciences. As our knowledge grows, and as problems become more complex, we shall depend more and more on these devices for their labor-saving capacities. The very high cost of producing an adequate scientist today demands that we use the scientist's capacity to the fullest. We must not hamstring him by demanding that he use nineteenth-century techniques for storing and retrieving vital data needed in his work. The growing tendency for science to cut across traditional lines of endeavor is another pressing reason for scientists to employ rapid information retrieval and data processing. The interdisciplinary endeavors in biology are reflected in such terms as biophysics, biochemistry, and more recently, the term biomathematics.

It is frequently heard among various groups of people, both scientists and certain knowledgeable laymen, that the science of taxonomy is passé, that the classification of organisms, both animal and plant, is satisfactory as it is, and that nothing more can profitably be done by exploring old problems further. This attitude unfortunately reflects the greatest ignorance of the real problems. The real value of taxonomy lies in its ability to correlate information, to show the relationship of organisms, and to shed more light on their various living functions. True enough, one aspect of taxonomy is in cataloging the plants themselves, and one might assume that once done, there is nothing else to do. However, as more scientists study more and more details of the fine structure of various experimental animals and plants, it is often imperative to re-organize the cataloging system in the light of their newer information. The process at its simplest level in taxonomy will therefore be constantly going on, reflecting the latest endeavors of the many biological sciences.

A criticism that has validity in scientific circles is that taxonomy, as it is largely practiced today, is more of an art than a science; that there is no quantification, nor demonstration of the methods by which conclusions are drawn. The theories and hypotheses utilized by systematists are seldom fully supported by their data.

At this point, the value of the computer comes into play. Several pioneering workers have attempted to use the computer in studying various complex groups of organisms. P. H. A. Sneath in England employed a computer to assist in correlations among various taxa (units, or entities) of pathogenic intestinal bacteria. Many biochemical tests have been used to differentiate the types of these important organisms. Some of the tests gave good data for taxonomic purposes, others gave inconclusive evidence either for keeping two or more types together, or for separating them. In all some seventy-five to one hundred tests were applicable to the several hundred organisms tested. Different bacteriologists used one or another of a small set of tests on which to base decisions of a taxonomic nature; naturally, there was considerable confusion among those interested in the identification of the various pathogens. This becomes important for the medical pathologist, who must identify the organism suspected of a particular set of symptoms and, on the basis of his identification, advise the doctor on the correct curative procedures. This is one case where a taxonomic decision can be vital. Fortunately, most taxonomic decisions need not be of primary importance in determining such a vital issue. Sneath felt that such decisions could be more accurate if he could correlate all the tests, and from these correlations make more objective judgments as to whether one particular organism is indeed different, or the same as another. One merely has to judge the enormity of the task of correlating the results of seventy-five tests for each of several hundred bacterial types, separately and in various combinations, to know that the only suitable approach that could be made would be with an electronic computer. In this, the data resulting from each of the tests for each type could be stored and then by suitable directions the computer could make the necessary comparisons. Needless to say, no taxonomist had ever before employed such a large number of characteristics with so many different types of organisms. No judgment of the relationship of the organisms, or the lack of relationship, was ever based upon such a wealth of data. It is unlikely that the decisions made by Sneath, using the computer as an extra correlative tool, will be upset by any further single test. In all fairness, it must be stated that Sneath's work did not upset previous studies very seriously. He confirmed some former judgments of relatedness, and was able to prove rather conclusively that other organisms were different from what they were formerly considered to be.

In the same year that Sneath published his work in London, two American entomologists at the University of Kansas, Michener and Sokal, demonstrated conclusively that the computer analysis of data from many species of bees was more adequate and much more rapid than previous techniques in taxonomy. Fortunately, these two had the experience of many years of previous work in bee taxonomy, and they were able to judge accurately the validity of their computer work. This has more value than is im-

mediately apparent. First, the computer work affirms that previous sound taxonomic work is not upset by analysis of additional characteristics, and that good taxonomic judgment, though intuitive, is valid. Secondly, and this is perhaps the more important, taxonomists may now quantify their observations rather than arbitrarily state that such and such a species is related to, is the same as, or entirely different from another. Such quantification will have the effect of permitting more ready acceptance of a taxonomic decision than has been heretofore possible. I am sure that some of my taxonomic colleagues will disagree violently with the last statement, and they may have justification for their stand. It is already possible to judge the adequacy of a taxonomic decision, without quantification, by recourse to the specimens cited by the taxonomist in his reported studies. But most working biologists, who deal with organisms in other fashion than taxonomic, haven't time to check each decision made by the taxonomist. It behooves the taxonomist, therefore, to use all available methods to assure himself of the adequacy of his work.

In 1958, Taffee Tanimoto and I made our first public report on the use of electronic computers in the taxonomic studies of a tremendous number of varieties (cultivars) of a tropical root crop, *Manihot esculenta.* For some time, I had been collecting samples of this highly important tropical food resource in order to make a sound classification of the cultivars and to show the relation of the cultivated species to the wild species in the same genus. As more collections were made, and more data accumulated, it became evident that I could not possibly correlate the various bits of information with ordinary taxonomic procedures.

In order to understand the methods employed in using the computer for taxonomic work, it was necessary to examine the basic assumptions and procedures in taxonomy. The taxonomic method had to be converted to computer language. This process in itself had great value, because I really had to get down to the fundamental principles, which previously I merely assumed, and to accept, modify, or discard them. This activity, which would form the basis of another paper entirely, will not be discussed here. It is well to say, however, that those of us who have used the computer have become aware of the necessity of this reexamination of fundamental taxonomic tenets, and it is likely that much more will be said about these problems in the near future.

If we evaluate the normal procedures employed by the taxonomist—the sorting of specimens, the examination of the literature to see how earlier workers have classified the same or similar plant groups, the integration of geographic distribution, the accumulation of genetic and ecological data—and by means of the computer speed up the difficult and slow parts of the process, then the techniques described below may have some value. Our program simulates the endless process of comparing each sample with every other sample in order to establish the degree of similarity between the two and thus to sort the samples into natural groupings or clusters for classification. No set judgment of the nature of a species or other taxon is implied. I, as a taxonomist, must decide what rank (species, subspecies, variety, etc.) will be assigned to the group.

At the beginning of the attempt to classify the varieties of *Manihot esculenta,* I did not know which characteristics of the plants would be most useful in the classification process. It was necessary, therefore, to collect as much information on each cultivar as possible in order to prevent the exclusion of some useful "measuring stick" for classification. For each variety, a photograph against a standardized photographic backdrop was made. All possible field information was included. Colors of the various parts seemed to be important, and they were recorded. Herbarium specimens were prepared to be used later for those characteristics that do not get lost in the pressing and drying process. The type of soil in which the plants were growing, the common name applied to the cultivar (if one were given), data on the use of the variety, all may have some significance for demonstrating the relationships of that cultivar to another.

Upon return to New York, all the data so collected, which were in very rough form, were placed in an ordered sequence. First, for each characteristic chosen, suitable subdivisions (attributes) of the characteristic, giving the range of variation of that characteristic, were established. For example:

Characteristic	Attribute	Presence
color of petioles	red	no
	red-green	no
	green	yes
	yellow-green	no
leaf-lobe number	3-5	no
	6-8	yes
	9-	no
HCN p.p.m.	less than-10	no
	11-30	yes
	31+	no

Note that the attributes chosen must be mutually exclusive, and that no more than one "yes" may be present for each characteristic. In a similar way, a wide range of characteristics are eventually tabulated, the number of characteristics used being determined only by their availability. Ideally, the characteristics should be inclusive of all evidence ever accumulated: genetic (including chromosome number, morphology, degree of ploidy, etc.), physiological, and ecological, as well as the standard anatomical and morphological characters.

Once the characteristics have been tabulated as above, they are prepared for the computer by recording each "yes" as a "1", and each "no" as a "0", thus:

TABLE I

Characteristic	A				B				C		D				
Attribute	a	b	c	d	a	b	c	d	a	b	a	b	c	d	e
Sample no. 1	0	0	0	1	1	0	0	0	0	1	0	0	1	0	0
Sample no. 2	0	0	0	1	0	0	1	0	1	0	0	0	1	0	0
Attributes in common, 1 & 2	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0
Distinct attributes, above	0	0	0	1	1	0	1	0	1	1	0	0	1	0	0

With the data thus recorded, the computer can compare each sample with every other sample, and through a series of computations, each directed by a specific set of "orders" (the program), the taxonomic value of each characteristic can be checked, and the samples ordered into groups. Many manipulations are involved before the final "output" from the computer, but the operations are very rapid.

As the program proceeds, one of the first products is a set of correlation coefficients. "Correlation" in this sense indicates the degree of relatedness, or the number of characteristics in common. Obviously, all the cultivars have many characteristics in common, or they could not be classified in one species *(Manihot esculenta)*. One could hardly expect to work with entirely unrelated organisms, or the value of the whole program is lost. It is, therefore, essential that the taxonomist be well versed in his science. He must also be able to select characteristics of the plant that have some significance for his purpose—the classification of a particular group of plants.

Table I shows the way in which the correlation coefficients are derived. For example, two specimens that have fifty per cent of the characteristics in common have a correlation coefficient of 0.500; seventy-five per cent of the characteristics in common, a correlation coefficient of 0.750; and so forth.

Careful selection of appropriate characteristics makes possible the valid use of the correlation coefficients. The correlation coefficients range from near zero for distantly related plants to near one for closely related specimens. The higher the correlation coefficient, the more closely related the plants are. It is possible, after computing the coefficients, to set up a sort of mileage chart as shown on Table II—something like those found on highway maps giving distances between cities. The taxonomist must judge the

TABLE II

SPECIMEN NO.

SPECIMEN NO.	70	289	225	236	154	190
70	1.00	.412	.715	.412	.262	.352
289	.412	1.00	.412	.333	.600	.262
225	.715	.412	1.00	.333	.333	.500
236	.412	.333	.333	1.00	.200	.262
154	.262	.600	.333	.200	1.00	.333
190	.352	.262	.500	.262	.333	1.00

Portions of matrix—the "mileage chart" of coefficients.

significance of his correlation coefficients in establishing a sound classification. For example, it is possible to say that all plants with a correlation coefficient arbitrarily established at .785 or higher should be considered as one species, one variety, or other taxon. Coefficients lower than .785 indicate lower degrees of relationship. We have employed techniques to remove some of the arbitrariness from the selection of the cut-off point, but the individual's judgment still plays a major role in establishing satisfactory limits.

Such an operation as this is not entirely automatic. There is, and should be, the judgment of the value of the work by the most significant single factor in the operation—the taxonomist. However, the judgment possible as a result of the computer program is much better because of the large storage capacity, the speed of the machine, and its precision in operation; also the making of decisions need not be so long delayed. The program also enables us to quantify our decisions and thus to remove one of the criticisms of the discipline.

Our program differs from Sneath's or Michener's and Sokal's in several technical ways, but these differences are not great, and there is little controversy about them. Each one developed his program without much knowledge that the others were working on the same lines. The fact that each had worked on widely different groups of organisms perhaps contributed to the former isolation.

The implications of computer application to taxonomic problems are numerous and quite exciting. Many former problems that involved such vast quantities of data that they seemed impossible to solve now come within the grasp of the taxonomist. Systematic studies of the tremendous variation in most cultivated plants can now be handled in periods that allow an individual to encompass the complexities of a group of cultivars. Previously one man might spend a lifetime in the process, and then only achieve partial goals. For example, the vast numbers of wheat varieties can now be more easily studied, using all the data available from the world literature, from present sources, and incorporating new bits of information as scientists gather it. Floristic studies, long the major output of the taxonomists of The New York Botanical Garden, can be greatly facilitated by using the storage capacity of the computers to put into order information that is now extremely laboriously correlated. Tropical floras, at best only just begun, should be helped tremendously by utilizing the storage and correlative capacities inherent in the electronic computers.

We hope in the near future to begin work on studies of marine algae, taking presently published monographs of marine algae and incorporating these into computer storage. Perhaps we shall be able to assist oceanographers, whose rapidly accumulating samples of marine plant life threaten to sink their program because of their inability at present to get the material properly classified.

These are some samples of possible actions with the help of the electronic computers. At the moment, we must buy or borrow time on computers that are owned or rented by much larger organizations than The New York Botanical Garden. This is hardly the ideal set-up, and one that may some day be overcome. Two stumbling-blocks are in the way, common complaints that are heard in many fields: first, a shortage of well-trained taxonomists, particularly those who are capable of using the computers to their best advantage; and second, a shortage of funds to attack the problems with the computers. Though the expense seems staggering, the increased knowledge and improved taxonomy will greatly overpay the costs.

THE BOERNER BOTANICAL GARDENS

By JOHN E. VOIGHT

Mr. Voight is Superintendent of the Boerner Botanical Gardens, Hales Corners, Wisconsin, and President of the American Association of Botanical Gardens and Arboretums.

THE MUNICIPALLY operated Boerner Botanical Gardens were established as the result of a consistent adherence to an ideal. About 1927, when the area was still in farmland, Charles B. Whitnall, frequently referred to as the "father of the Milwaukee County Park System," became interested in securing the land for a large rural park. He frequently visited the place with the late Alfred L. Boerner, at that time County Landscape Architect. It became Mr. Boerner's dream that a portion of this picturesque land should be devoted to the development of a botanical garden, and when this was actually accomplished, the garden was named after him [in October, 1958]. Working together, and with the support of dedicated park commissioners in 1929, he and Mr. Whitnall succeeded in arranging for the acquisition of six hundred and fifty-five acres, ten miles southwest of downtown Milwaukee. The north portion was set aside for the development of a botanical garden.

In 1934, the Federal Government developed a "green belt" housing project adjoining Whitnall Park and dedicated fourteen hundred acres to Milwaukee County for public park and parkway purposes. This land, known today as the Root River Parkway, functions as an addition to Whitnall Park, making a total combined ownership of two thousand, six hundred and fifty-five acres.

Whitnall Park is a superb piece of typical Wisconsin terrain. Through it flow two spring-fed brooks which are bounded on either side by wooded hillsides. Many different habitats are available for plants—without much searching a situation can be found for even the most exacting plant. The major development was accomplished through various Federal Works Projects, including the Civil Conservation Corps, the Works Project Administration, and the National Youth Administration, during the years 1930-1940.

The Boerner Botanical Gardens are easily accessible from several of Milwaukee County's traffic arteries and by public transportation. They are open to the public seven days a week, from 7:30 a.m. to sunset. There is no admission charge.

The Gardens are divided and subdivided into unique units of floral groups and displays. These include annuals, perennials, herbaceous and tree peonies, irises, day-lilies, bulbs, hardy asters, phlox, hardy lilies, chrysanthemums, roses, rock and alpine plants, herbs, and others.

In the walled garden colorful flowers, trees, shrubs, hedges, groundcovers, and water features have been artfully combined to create an inspiring effect. Over sixteen thousand annuals are required for this spectacular unit, which represents the main entrance to the Botanical Gardens. Unsuspecting visitors who wander in casually are pleasantly surprised by the diversity and quality of the plant materials. It is here that examples of floral composition for mass effect, for color, for texture of foliage, and for flower and foliage combination may be observed and studied. In a shaded spot there are groupings of approximately seven hundred tuberous-rooted begonias.

The west mall presents a colorful, ever-changing garden

Left. View into the rose garden from the vine-clad arbor.

Below. Over sixteen thousand annuals are raised for display in the walled garden.

picture of interesting perennials, and it has been most successful in stimulating an interest in perennial gardens. The south mall contains tree peonies, phlox, hardy lilies, delphiniums, hardy asters, and chrysanthemums. Appropriate shrubs and trees furnish an attractive background.

The rock garden simulates a natural limestone out-cropping. Here grow the alpine and other suitable rock garden plants, with specific shrubs and trees that like the situations afforded by the man-made rock ledges.

The rose garden is without doubt the most popular of all the garden units. Its display of fine varieties, grown to perfection, have quickened the desire in visitors to grow good roses in their own gardens. The plantings contain about five thousand plants of three hundred varieties of hybrid teas, floribundas, grandifloras, climbers, hybrid perpetuals, and species. The Boerner Botanical Gardens aim to show the finest of the new and a worth-while representation of the older, still unsurpassed varieties.

The herb garden, the newest unit and established in 1956, comprises a fascinating display of aromatic, culinary, and medicinal plants. There are over two hundred species and varieties of herbaceous plants, and forty species of trees and shrubs of herbal value. One of the features that has helped to make the herb garden more interesting and educational is the method of labeling. Each plant is labeled attractively and legibly, not only with the botanical and common names, but frequently with the foreign names (French, Italian, German, Polish, and so on). These names are often more familiar to older generations.

The day-lily garden, located west of the south mall, has served well in guiding garden enthusiasts to grow this "flower with a future." The numerous varieties are displayed on a side hill that provides an excellent location for growing and evaluating them.

The spectacular peony garden, located west of the Administration Building, contains one hundred and seventy-five varieties—the outstanding new ones as well as the best of the older ones. This garden always attracts thousands of visitors when it is at the peak of bloom during the last week in June. Another noteworthy collection consists of ninety-five varieties of tree peonies. It creates an annual

The herb garden contains herbaceous plants, shrubs, and trees of aromatic, culinary, and medicinal value.

Right. One of the educational labels in the herb garden.

There are seven hundred trees, representing one hundred and seventy-five species and varieties, in the flowering crab-apple collection.

The lawn test plots are one of the important services for the public at the Boerner Botanical Gardens.

The Administration Building of the Boerner Botanical Gardens.

stir among the visiting public and has done much to awaken interest in growing these majestic flowers in the Milwaukee area.

The trial garden, devoted to annuals, roses, mums, dahlias, gladiolus, hardy lilies, dwarf fruit trees, ornamental trees and shrubs, and lawn test plots is gaining reputation as one of the nation's top public gardens in such services. It is one of the official test gardens, scattered throughout the country, where roses and mums are grown and judged for All-America Selections.

The collection of some forty thousand tulips, representing two hundred and seventy-five varieties, delights visitors with its beauty; at the same time it demonstrates how tulips should be grown and used in the landscape. All the known types and colors are represented, and all are legibly labeled.

Each year has been a steady advance in the development of the collection of woody plants. The picturesque natural woodlands provide an excellent background for the plantings. A careful selection in the arrangement of trees and shrubs has facilitated a composition by comparison. The selection also enables a general estimate to be made of their value for ornamental use. Great strides have been made in starting major permanent collections of flowering crab-apples, lilacs, maples, oaks, locusts, spruces, cedars, yews, junipers, pines, willows, ash, birch, hawthorns, viburnums, cotoneasters, euonymus, and others. Each collection has been designed for its landscape effectiveness as well as its usefulness in the study of plant material. A great deal of thought, time, and effort have been expended on the labels. As the plants become large enough, engraved plastic, wood, or metal labels are attached to them. The text is prepared with the utmost care; it affords accurate data for the student as well as descriptive information for the lay visitor.

The Administration Building accommodates the lecture room, exhibit area, horticultural reference library, herbarium, and offices. It is interesting to observe the wood carvings in this building, as well as the furniture and fireplace mantel in the library. All were produced under the Federal Works Project in 1936.

Recognizing the need for organized nature study, the Boerner Botanical Gardens inaugurated the "Nature Program." This resulted in three trails: nature, hiking, and evergreen. These trails wind through picturesque natural and man-made park and parkway areas, interesting throughout the four seasons of the year. Each trail has numbered rustic posts to correspond with illustrated guide booklets; these are available at a small charge. The booklets are designed primarily for people without technical training.

A series of lectures and guided tours are offered to garden and nature-study groups. Outdoor garden clinics are conducted to acquaint amateur gardeners with authoritative garden information. School classes, 4-H clubs, and Scout troops are encouraged to visit the Boerner Botanical Gardens frequently for instruction and inspiration. These popular programs are well attended. The local radio and TV

stations and the newspapers are most cooperative in publicizing programs and in publishing information.

Continuous public service on garden and plant information is rendered by telephone, mail, literature and personal contact. A good supply of salable educational items—books, periodicals, games, and the like—is available in the Administration Building.

This significant institution in Whitnall Park has created a garden-minded community of people from all walks of life. It has awakened the average home owner to the vast possibilities of making his home grounds a place of beauty. It will ultimately become the nucleus of a more beautiful, cultural metropolitan area. Over a million people visit the Boerner Botanical Gardens annually, indicating to the Milwaukee County Park Commission that they are fulfilling a good public service.

AWAKENING AN INTEREST IN THE NATURAL SCIENCES

PUTTING LIFE into the study of living things was the goal of the Biology Seminar held during the past summer at the New Providence, New Jersey, High School. Twenty students registered for a course that gave no credits towards the high school diploma, but did give them a better understanding and appreciation of the world of nature through first-hand observation rather than through textbooks or preserved specimens. The seminar was held one day (all day) a week for ten weeks with each day devoted to a different area of biology. The only prerequisites to participation in the seminar were one year of biology and an interest in learning more.

The schedule included laboratory sessions on instruments, as well as discussion of aims and organization; on embryology; on comparative chordate anatomy with emphasis on primitive chordates; and on the students' special projects. Biological films were shown one day. Field trips were taken to the wild-flower trail in Jockey Hollow National Park; to nature trails in Watchung Reservation; to Longwood Gardens; to Stokes State Forest, and to Island Beach State Park.

The field trips represented a variety of biological environments. Each area was studied systematically by the seminar students in study groups of two or three, with each study group concentrating on a certain area as trees, wild flowers, protozoa, algae, fresh-water plankton, birds, ferns, macroscopic water animals, and nature photography.

The first field trip—to the wild-flower trail in Jockey Hollow—was an "eye-opener" for the students, since they began to realize for the first time exactly how fascinating nature study can be. The group moved at a leisurely pace through the trails and stopped frequently to examine more closely or to "key out" particular plant specimens. The wild-flower group was able to collect about twenty specimens (not from the wild-flower trail) for their herbarium, which were just enough to whet their appetites for future trips. This trip was kept short (two hours on the trail) intentionally to insure a sharpening of interest rather than a dulling that might have resulted with this age-group if the hike had been long. The class returned to the laboratory to complete the work of classifying, mounting, printing leaves, and so on.

The second field trip took the seminar students to nearby Watchung Reservation for a five-mile hike under the leadership of Dr. Harold N. Moldenke, Director of Trailside Museum. Under the excellent tutelage of Dr. Moldenke, they added forty-nine wild flowers to their herbarium, as well as many new trees (leaf prints), and sighted birds new to them. Most rewarding of all was the introduction of the class to such a remarkable biological area less than three miles from their school. They saw with their own eyes how rich it is in zoological as well as botanical specimens. Dr. Moldenke set a rapid pace in order to show as many areas as possible in the time allotted, so there was no time for close examination on the trail; but specimens were collected by him for the students to study upon their return to the laboratory.

The remaining trips to Island Beach, Longwood Gardens, and Stokes State Forest afforded hours of adventure in the world of nature for this group of teen-agers.

During the regular school year the Biology Club conducts similar studies. Field trips for this particular group included Longwood Gardens (during Christmas vacation), Ciba Pharmaceutical's research laboratory, and the Great Swamp in Morris County during warbler migrations.

Much of the credit for this Biology Seminar must go to the students who are truly learning for the sake of learning. The only rewards are what they derive from their efforts. Credit must also go to the Board of Education of New Providence, New Jersey, for its permission and support for this experiment in education.

It has been a successful experiment—the enthusiasm of

Robert G. Gorton, instructor, and a student collect freshwater plankton and search Seeley's Pond for bullfrog tadpoles for experiments in development.

the students carried through to the end of the seminar. Mr. Gorton recorded the seminar on 35 mm. kodachromes so that the experiment could be shared with other schools and groups interested in initiating similar seminars. Such seminars may create a life-time interest in one of the natural sciences as a hobby or may lead to the choice of a career in biology—botany, zoology, or ornithology.

ALONG NATURE TRAILS IN THE WATCHUNG RESERVATION

On July 19, 1961, eleven students of the New Providence, New Jersey, High School arrived at the Trailside Museum in the Watchung Reservation with their instructor, Robert G. Gorton, Chairman of the Science Department. In making the reservation with Dr. Harold N. Moldenke, the Museum's Director—and such a reservation, because of the great number of groups, must usually be made in writing three to five months in advance—Mr. Gorton had requested that the formal two-hour program be replaced by a more informal nature walk along some of the area's many trails. Normally, a group is given a twenty-minute lecture, profusely illustrated by colored slides, on local plants and animals, or on any other nature topic which the leader requests. This is followed by a forty-minute guided tour of the Museum's exhibits, a twenty-minute visit to the zoo, and a forty-minute walk on one of the three marked nature trails. But for this particular group of students three hours were spent on narrow trails which wind through woods and fields, along brooks and quiet ponds, and by grassy meadows and roadsides.

Collecting any plant, animal, or geologic material in the two-thousand-acre reservation is strictly forbidden for obvious reasons. However, special permission was granted to collect one specimen each for a school herbarium. Such permission is granted, on occasion, to groups with a definite scientific or educational intent, provided that the Director accompanies the group and does the actual collecting.

Dr. Harold N. Moldenke identifies a wild flower for a student, who is holding some specimens for the school herbarium.

The group did not follow the regular nature trails along which classes of all ages are conducted up to four times daily by the Director and his educational assistant, Irma H. Heyer, a retired school principal from Elizabeth, New Jersey. On these trails collecting is never permitted. Instead, the group traversed some of the many hiking and bridle trails and returned along the margin of an automobile road, covering in all perhaps five miles.

About one hundred and fifty species of native and introduced trees, shrubs, vines, herbs, and fungi were observed, and a number of birds and mammals were identified by sight or their call, as well as scores of insects and their homes. Among the trees were tulip-tree, red, black, white, swamp white, pin, and rock oaks, American and hop hornbeams, red-cedar, Canada hemlock, red, white, and pitch pines, red, silver, sugar, and black maples, box-elder, pignut, butternut, black walnut, osage-orange, sassafras, American and slippery elms, flowering dogwood, sweet and wild black cherries, and sour gum.

In a clearing near the burial ground of the old "Deserted Village," whose history dates back to the seventeenth century, Dr. Moldenke pointed out bayberry, huckleberry, deerberry, lady cornel, and highbush blueberry growing among the Indian grass and bearded brome grass, used by the early settlers. Several species of huckleberry, blueberry, dewberry, blackberry, and raspberry were seen in abundance, as well as the bird-introduced wineberry, oriental bittersweet, and Morrow bush-honeysuckle.

Some of the students were "thrilled" to see for the first time silver poplars, and the ancient European lindens that had been introduced before the Civil War by "King David" Felt in the village that he ruled like a monarch of old. They were also interested in the Chinese tree-of-heaven that was introduced at a later date to serve as host for the ailanthus silk moth, now our largest moth. Others were fascinated by the colonies of Indian-pipes which were poking up through the leafmold in secluded groves and by the magnificent orange butterflyweed which enlivened several sunny fields. Korean bush-clover stood like sentinels in the same field or, more aptly, like stiffly advancing soldiers about to take over the area. A belated yellow flag was still blooming in the brook running through the Drake's Fields which are a mecca of all bird-watchers in the region.

Dr. Moldenke gave the students the scientific and common names for every species seen and also enlivened the walk with stories about the plants and animals from mythology, folk lore, and history. He spoke of the drops of "princess blood" on the velvety leaves of jumpseed, the feeding of loosestrife to oxen in early times to make them lose their tendency to strife, and of the "machine guns" on the witch-hazel and the use that school children often make of them. He told of the excellent "swords" and "spears" that children make of blue wild-lettuce stems in winter, of the arrow-wood or dockmackie of the Delawares, and of the "dolls'-eyes" ripening on the white baneberry stalks. The differences between poisonous and non-poisonous sumacs were brought to the students' attention, and the deadly water-hemlock compared with the edible sweet-cicely.

(Continued on page 224)

PLANT-ANIMALS AS EXPERIMENTAL TOOLS FOR GROWTH STUDIES

By S. H. HUTNER

Dr. Hutner, Associate Research Director of Haskins Laboratories, discussed this subject at the symposium on "Fundamental Developments in Plant Growth" sponsored by the Torrey Botanical Club and AAAS Section G at the December, 1960, meeting in New York City of the American Association for the Advancement of Science.

SOME PROTISTS,* like the hardy, fast-swimming, deep olive-green, photosynthetic, voracious chrysomonad flagellate *Ochromonas danica,* combine the decisive attributes of plant and animal. Most textbook discussions of plant versus animal are fogged by timidity, when protists rather than oaks and elephants are discussed. Even the most zoophobic misanthrope of botanists must concede that in comprehending what "plant" means, insight about animality helps. No less must the student of animality appreciate the plant origins of many of the devices uniquely animal, for example, vision.

In 1876 Huxley defined animals as eaters. In 1954 Haldane described animals as wanderers seeking fuel and ready-made spare parts—if one adds "characteristically ingested in chunks," he has a workable primary definition. Electron-microscope and isotope-tracer experiments emphasize that the talent underlying eating is appreciable synthesis of food-vacuole membrane. Organisms unable to do this are plants. They have other specializations: photosynthesis, the elaboration of external digestive enzymes as in heterotrophic bacteria and fungi that obtain nourishment from decaying matter, or efficient systems for using dissolved nutrients. Since *Ochromonas danica* can live by photosynthesis, with all its carbon coming from CO_2 except for those traces represented by its requirements for thiamine and biotin, it can live as a plant. It also can live in the dark on particles, that is, as an animal. Rather than set up a kingdom Protista and say "animal-like" or "plant-like," it seems better to call *O. danica* and similar protists plant-animals, which accords with their experimental uses. The investigator chooses whether his problem is of zoological, botanical, protistological, or protozoological interest; the organism does not care.

This paper outlines some ways in which these plant-animals are uniquely suited for investigating otherwise hardly accessible processes in plant and animal growth. We may thus see deeper into *plant* and *animal.*

EXPERIMENTAL ADVANTAGES OF GLUTTONOUS PLANT-ANIMALS

Ochromonas danica has an enormous capacity to digest prey. I have watched a few individuals in a hanging drop gorge on dense populations of *Escherichia coli* [the colon bacterium], nearly wiping out the bacteria while multiplying prodigiously. That ingested bacteria can be nutritionally effective was shown earlier in a subtler way: *O. danica* satisfied its biotin requirement when fed bodies of *Thiobacillus thioparus,* whose biotin was presumably all bound since it was unavailable to a biotin-requiring coccus.

Ochromonas danica, a glutton, must, like humans in the hunting stage of social development, gorge when it can to prepare for lean times ahead. In gorging, it must cope with surges of fuel and building blocks. What happens when *O. danica* is given all the simple building blocks and fuel it can handle, that is, allowed a sustained gorge? This question is not simple; exploded hypotheses clutter our notebooks. Unexpectedly, at high concentrations of superior substrates, for example, the combination of glycerol and propylene glycol, growth increases sharply but nutrient imbalances appear. At lower concentrations of substrates such imbalances do not hinder growth. The additional growth requirements induced in *O. danica* by incubation at elevated temperatures resembled those induced by media containing excess methionine. We now think that the common denominator in these "metabolic stress" experiments is a speeding-up of growth which exaggerates the demands for certain nutrients, notably certain trace elements and vitamins, and induces lethal imbalances in utilizing amino-acid. And, under still greater stress, imbalances develop in the utilization of as yet unidentified lipids.

The *O. danica* results are now outrunning the literature on rat and chick nutrition which guided our early experiments. The appearance of amino-acid requirements under the stress of greatly speeded growth seemingly has its counterpart in the chick, whose high body-temperature (40-42° contrasted with our 37°) and rapid growth cause it to outstrip its capacity to synthesize such "unessential" amino acids as glycine and arginine. Also the appearance of a B_{12} requirement when *O. danica* was given excess methionine + glycine along with certain supplementary nutrients may, in view of the multiple interconnections between B_{12} and folic-acid synthesis and function, have its counterpart in the enhanced folic requirement of chicks fed excess glycine. The enhanced B_{12} requirements in animals given thyro-active materials and in *Ochromonas malhamensis* grown at elevated temperatures fit into place as consequences of speeded growth.

Vertebrates, including humans, treated with thyro-active substances, have enhanced nutritional requirements besides that for B_{12}. These nutrients have not yet been identified for the rat; likewise, supportive diets for thyrotoxic patients are primitive.

Extensive damage in higher animals is followed by a wasting of skeletal muscle and negative nitrogen balance, which is not alleviated by ordinary high-caloric or high-protein diets. This process is controlled by the anti-shock cortical hormones. If in emergencies higher animals do fall back upon an ordinarily inconspicuous metabolic pathway to make ready fuel and repair parts, centering around certain amino acids and related compounds, comparison of

*Protista, or protists, are, in general, miscroscopic living beings, both plant and animal.

metabolic stress in higher animals and protozoa may reveal a common denominator. It becomes of evolutionary and taxonomic interest to look for corresponding systems imbedded in different plant lines. This emergency system may include one or another of the newly discovered metabolic cycles in which vitamin B_{12} figures.

Experiments with fast-growing ciliates indicate that efficient substrates can be overlooked because while giving growth an immediate impetus, essential syntheses lag, especially of amino acids and of vitamins and other co-factors for metabolizing these substrates directly or for preliminary conversions into metabolizable forms. Paradoxically, then, rapid growth may lead to poor growth. Metabolic stresses can be alleviated—and so identified—in organisms amply permeable to nutrients that relieve these strains. Otherwise one sees an irremediable lethal condition. Complicated amino-acid balances are not new in plant-tissue culture. One wonders how many coconut-milk factors are no more than brittle balances. All "protein" and "peptide" factors have so far in microbiology been resolved into amino-acid balances, sometimes complicated by peculiar trace-metal requirements or trace requirements for fatty acids or sterols.

Dr. William C. Steere, Director of The New York Botanical Garden, has said: "The unifying force of systematics in the fields of botany and zoology gives it a transcendental importance as yet too little recognized." The following is adduced in support:

A characteristic separating green plants and higher fungi from other creatures is their lack of B_{12}. Strict vegetarians come down with a facsimile of pernicious anemia, unless they are lucky in having intestinal bacteria which are good B_{12} producers. One must understand the distinction between *containing* and *requiring* B_{12}, before regarding B_{12} as the thread of Ariadne that leads through the taxonomic labyrinth of the many protistan groups of puzzling position. (How delightful to assign *this* group to the orthodox plant kingdom and *that* one to the main animal lines, just as in Gilbert and Sullivan's *Iolanthe* each child born alive is either a little Liberal or else a little Conservative.) An organism neither containing nor requiring B_{12} should be shown to lack any reaction accelerated by B_{12}. This caution is suggested by *Euglena:* it requires B_{12} and does not contain any, as measured by all available assay organisms such as higher animals, *Euglena* itself, various bacteria, and *Ochromonas malhamensis.* The taxonomic characteristic represented by B_{12} distribution has economic as well as medical importance: plant feeds for farm animals are now supplemented by "animal protein factor," whose main potent ingredient is B_{12}, usually made by special microbial fermentations. The extremely rapid growth and efficient food conversion permitted by these supplements have helped set the stage for investigations on the importance of nutritional balances for efficient growth. Dr. T. H. Jukes of the American Cyanamid Co., is, with his associates, the pioneer in this field.

Ochromonas malhamensis (smaller than *O. danica* and poorly photosynthetic) has a B_{12} requirement exactly like man's and not like *Euglena*'s; the two patterns are quite different. Our faith that the vitaminic resemblance between *Homo* and *Ochromonas* is more than convergence is encouraged by the remarkable parallel recently becoming apparent to us that all the compounds oxidized by higher animals appear to be utilized by *O. danica,* either when tried singly or when sparked by other substrates. Since B_{12} figures conspicuously in stress reactions, any phylogenetic scheme for the different animal lines which lays emphasis on B_{12} patterns needs buttressing by a concordant taxonomy of stress reactions. And so a new taxonomic problem arises: which inducers of stress are the fundamental ones—elevated temperatures, abnormal nutrition, or certain chemotherapeutic agents and herbicides?

ENDOCRINOLOGICAL SEPARATIONS OF PLANT AND ANIMAL

In 1957 Wooley suggested that serotonin may be the counterpart of indoleacetic acid: that in plants, whose sap is acidic, the acidic auxin has evolved; and in animals, where the juices are rather alkaline, the corresponding base serotonin operates and, in some lower vertebrates, tryptamine. All, he thinks, may act by altering permeability to calcium and magnesium.

Here clearly posed is another problem in finding a common denominator between plant and animal.

The hormones of cellular organisms regulate the choices between using materials as building blocks or as fuel—insulin and steroid hormones are striking examples. If in land plants, as elsewhere, *inter*cellular hormones had their origin in *intra*cellular regulators, then a unicellular green alga, if subjected to metabolic stress, might have its capacity to synthesize hormones so heavily drawn upon that its growth might become dependent on exogenous hormones or hormone precursors. Which green plant to try? Such unicellular forms as *Chlamydomonas* or its colorless counterpart *Polytoma* have a very restricted permeability. The photosynthetic pigments of the euglenids are nearly identical with those of green algae. In other molecular respects *Euglena* resembles higher fungi; for instance, it contains ergosterol.

Euglena gracilis is permeable to a fair range of compounds, but it does not ingest particles and so is a poor experimental object as compared with *Ochromonas* or cellular animals for studying nutrition under stress. But the euglenids include many animals of unmistakable euglenoid antecedents. One of them, *Peranema trichophorum,* in pure culture has nutritional requirements which include any of a variety of "plant" sterols (for example, sitosterol, stigmasterol, ergosterol) or "animal" sterols (for example, cholesterol), unsaturated fatty acids, and a wide assortment of water-soluble factors. Its voracity is satisfactory: it can ingest whole small euglenas or cut holes in and suck the juices from larger euglenas. We had found nutritional analysis difficult, because it needs surfaces and had a narrow range of tolerance for fatty factors supplied according to the knowledge of that time (1953). Recent advances in (a) ways of supplying lipid materials; (b) knowledge of amino-acid balances in nutrition; (c) knowledge of the effectiveness of methyl cellulose and the like hydrophilic particles which provide surface and so allow three-dimensional growth in culture vessels; and (d) advances in biochemistry, especially in knowledge of switching points between fuels and biosynthetic intermediates—all urge a thorough study of this animal, especially the pattern of its B_{12} requirement.

"CONTROLS" IN ELUCIDATING GROWTH REGULATORS IN PLANT-ANIMALS

The remorseless logic of the preceding argument leads to the conclusion that the proper studies of botanists who seek to identify the intracellular mode of action of plant hormones are plant-animals like *Ochromonas* and animals like *Peranema*—the more voracious and gluttonous the better. Certainly the impotence of the orthodox botanical approaches to the problem, however valuable once in discovering these hormones, means that other approaches are needed; why not an attempt to outflank from the animal side?

In assigning "plant" and "animal" characteristics to protists, a precept enunciated by an eminent molecular botanist, Dr. D. M. Bonner, might be recalled: a biological experiment cannot have too many controls. For the present purposes this means comparisons with as many kinds of organisms as possible, before we dare conclude that the common denominator between chrysomonads and metazoa is *the* animal metabolic pattern, and that between the euglenoid and other green-pigmented groups is *the* plant pattern. Only a few controls can be mentioned here. One wishes that some of the vast and repetitious effort put into studying the plant hormones had been diverted into analyzing growth regulation in the multicellular brown and red seaweeds, and the many kinds of green algae having multicellular organization. Recent advances in the cultivation of marine algae point to a wide-open field.

Knowledge of the nutrition of other protozoa, notably of ciliates and trypanosomid flagellates,** has advanced to where their metabolism under stress is accessible to analysis. Eventually these, it is expected, will be joined by members of the Acrasiales and other groups having ameboid stages in the life cycle. These might be termed plant-animals but in a different sense, since here the emphasis is on the apposition of ameboid feeding stages with immobile reproductive stages culminating in cyst formation.

The dinoflagellate plant-animal line is beginning to be explored biochemically. The possibilities are exciting, as they include some of the most elaborate of pure animals, for example, *Noctiluca,* as well as photosynthetic forms, with and without abilities to ingest.

PRACTICAL USE OF PLANT-ANIMALS

Determination of B_{12} by *Ochromonas malhamensis* is widely used as a replacement for chick and rat assays; it is the official method in Britain. A new use is developing —screening for anti-cancer agents. Several pharmaceutical firms are employing chrysomonads with some success; details should be published in a year or two.

The patterns of susceptibility to chemotherapeutic agents are in themselves taxonomic characteristics. The manifold distinctions between antibacterial and antiprotozoal drugs throw into relief the many overlappings between antifungal and antiprotozoal agents. Should *Ochromonas* efficiently detect compounds specifically cytotoxic to higher animal cells as compared with green-plant cells or, conversely, should *Peranema* detect compounds specifically herbicidal but harmless to chrysomonads and metazoa, the taxonomic scheme inferred from the present discussion would be supported. If plant-animals should efficiently detect toxicity to metazoan cells, then they might become useful in detecting those herbicides, insecticides, and other agricultural chemicals that present unreasonable hazards to higher animals.

Chlorophyll formation in *Ochromonas danica, O. malhamensis,* and *Euglena gracilis* is inhibited by the herbicide 3-amino-1, 2, 4-triazole; as measured by growth inhibition, *O. danica* and the duckweed *Spirodela oligorhiza* were about equally sensitive. Amino-triazole inhibition of growth and chlorophyll formation in *O. danica* was annulled by iron, in part by cholesterol, and also by adenine but not by riboflavin; the combination of iron and adenine was reported to be very effective. This instance is cited to indicate how convenient *O. danica* is for mode-of-action studies of cytotoxic materials.

Another source of information drawn on for plant-animal studies is the trouble ruminants occasionally have in coping with surges of ketonic acids. Little if any carbohydrate is absorbed by the cow from the contents of its first stomach or rumen; ruminants depend on aliphatic (fatty) acids. Ruminants may have retained—or developed—metabolic pathways not obscured by the usual predominance of carbohydrate utilization. One of the original reasons for trying propylene glycol on *O. danica* was that it corrected ketosis in cattle as well as glucose did. The role of corticoid steroid hormones in accelerating interconversion of carbohydrate and other foodstuffs is dramatically shown by their effectiveness in treating ketosis.

Screening programs are tedious, expensive but inescapable, and so the most information possible should be derived from them. Detection of cytotoxic materials that show differential toxicity as distinguished from general "protoplasmic" poisons point up a situation which has changed from joke to occasional actuality: a cytotoxic material may be a cure; the trick is to find the disease. The range of test systems might embrace viral, bacterial, protozoan, and fungal pathogens; herbicides; and tumors. Dr. Jukes has given examples of how the compounds and concepts of one branch of chemotherapy apply to another. Plant-animals may be versatile tools for identifying the "disease."

I have acted as spokesman for a group of colleagues and students, but they are not to be held responsible for imprudence in leaping at conclusions. The work on plant-animals was aided by grants from the Loomis Institute, the American Cancer Society, and from the National Institutes of Health, the United States Public Health Service.

A particular type of protozoa that attacks the blood of animals, including man, and is usually transferred by a biting insect. For example, **Trypanosoma brucei, which infests the blood of horses and cattle, is conveyed by the tsetsefly, while T. **gambliense** is conveyed by another fly or mosquito into the human blood stream and causes sleeping sickness.

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PRESERVATION OF OUR WILD FLOWERS

By MARTHA COMPTON

Mrs. Compton has been an enthusiastic gardener for twenty-five years, has lectured on gardening and on conservation and wild-flower preservation, and contributed to a number of horticultural publications on these subjects. The weekly column, "Life in the Country," which she conducted for five years, is being prepared for publication as a book by Rand McNally. Mrs. Compton is active in garden club affairs in her state of Illinois, particularly in conservation, and in civic planning and planting.

WHILE THE SAVING of our wild flowers may seem to be a very small part of the large over-all conservation program, to the flower lover and to the naturalist it is an important part. The individual is apt to feel helpless in the face of such a tremendous project, but there are ways in which individuals can help to save wild flowers from extinction.

A superb effort is being put forth by arboretums, botanical gardens, and special gardens across the country in establishing and maintaining wild flower "walks" or trails or small areas, where wild flowers are within easy access to be seen and enjoyed and are well marked. These institutions welcome our interest in and support of their efforts along this line.

Another fine effort is being made by the garden clubs, both state and local. These clubs realize that it is up to them to take active measures for the protection of our wild flowers. With the permission of the proper authorities, garden clubs are planting in forest preserves, in local woody tracts, and in public parks the wild flowers that are found growing in their particular communities. Here again the plants are clearly labeled; sometimes a neat and attractive fence encloses the planting, and a rustic bench is placed nearby. Those of us who are members of garden clubs participate in their conservation projects.

The third is definitely a "do-it-yourself" project. Many gardens or suburban backyards have a small corner, perhaps part of it partially shaded, where a few favorite wildings can be grown. A number of these plants are easily cultivated. It is a delight to have them close at hand to observe and study—at the same time to help, in some small way, to conserve our heritage of wild flowers for coming generations.

It is well to plan in advance before you start to make a wild-flower or native-plant garden. For your initial venture, I suggest that you select plants that are not particular about sun or shade or soil, and that grow naturally in your locality. If you refer to one or more of the excellent books on wild flowers*, you will learn that many grow over a great part of this country, others are regional, and some quite local in their range. The old-fashioned "butter and eggs" *(Linaria vulgaris)* roams over a wide area. Actually,

Jack-in-the-pulpit *(Arisaema triphyllum)*

this is not a native but a plant from abroad that has become naturalized in North America; it is native to parts of Europe and Asia. *L. vulgaris* grows in sunny places. Blue chicory *(Cichorium intybus)* is another European plant that has become extensively naturalized in northern North America. This perennial with azure-blue flowers is found in sandy soil along sunny roadsides. A wild flower with an extensive eastern range is *Rudbeckia hirta.* It is seen in meadows, along roadways, and at the edge of woods from Ontario to Florida and Texas, in dry sandy soil, in clayey soil, and in moist humus soil. The handsome false hellebore *(Veratrum viride)* grows in the wild from New Brunswick, Canada, westward to Minnesota and southward to Georgia. It likes cool, moist shade. Solomon's seal *(Polygonatum biflorum)* and false Solomon's seal *(Smilacina racemosa)* are found in half-shady situations and usually in moist soil.

As you progress with your wild-flower garden, you will want to grow some of the choice, difficult-to-grow native plants: the pink and the yellow lady-slippers *(Cypripedium acaule* and *C. pubescens),* the double, and rare, bloodroot *(Sanguinaria canadensis fl. pl.),* trailing arbutus *(Epigaea repens),* and Oconee-bells *(Shortia galacifolia).* These plants require special attention as to soil and location. Some people are successful in growing them for a number of years; in other gardens they fail within a few years. You will also want trilliums. *T. grandiflorum,* one of the best for the wild-flower garden, is easily grown; *T. undulatum,* painted lady or wake-robin, is one of the most beautiful, but more difficult to establish than *T. grandiflorum* and some of the other species.

It is best to obtain plants from a nursery specializing

***BOOKS ON NATIVE WILD FLOWERS**

House, Homer D. **Wild Flowers,** Macmillan Co.
Hylander, Clarence J. **Macmillan Wild Flower Book.** Macmillan Co.
Kieran, John. **Introduction to Wild Flowers.** (Hanover House) Doubleday and Co.
Lemmon, Robert S. and Charles C. Johnson. **Wildflowers of North America in Fall Color.** (Hanover House) Doubleday and Co.
Mathews, F. S. **Field Book of American Wild Flowers.** G. P. Putnam's Sons.
Steffek, Edwin F. **Wild Flowers and How to Grow Them.** Crown Publishers.
Swain, Suzan N. **Plants of Woodland and Wayside.** Doubleday and Co.

Black-eyed Susan *(Rudbeckia hirta).*

Virginia cowslip *(Mertensia virginica)*

in wild flowers or native plants. There are several reliable ones. The species or variety will be true to name, and the root growth will be superior to that which is dug from the woods or meadows. *If, however, you have been granted permission* to dig plants from their natural growing place, take care to dig very carefully, to remove whenever possible only a portion of the plant, and to let enough remain for future increase. Cover the remaining roots with soil and tamp it down, so the plant is left in reasonably good shape. Wrap the part that you dug up in wet newspaper, and plant it as quickly as possible. Keep the new planting moist, not wet, until it is well established; and pull out the weeds for the first year or two. After that, the wild flowers should crowd out any undesirable weeds.

To begin your planting with the spring cycle, there are the hepaticas *(H. acutifolia* and *H. triloba),* sometimes called liverwort, blue anemone, and Mayflower. (The correct botanical name of *H. triloba* is *H. nobilis;* but it is still given as *H. triloba* in the listings of wild-flower specialists.) Hepaticas bloom early, even in snow, and are easy to transplant and also to propagate by division. They are occasionally planted in the perennial border where the leaves, three-lobed, light green in spring, dark green in autumn, and of good texture, add a distinctive touch. The delicate flowers, borne on silky-hairy stems, may be lavender-blue, white, or even rose-pink. *H. acutifolia* and *H. triloba* do best in shadier spots of the wild-flower garden in rich woodsy soil that is not too acid.

Jacob's ladder *(Polemonium reptans),* whose lovely bell-like flowers are blue, the blue of the sky, also blooms in early spring. This plant has defied yearly mowing on a nearby country road. It is a happy selection for the wild-flower garden, for its narrow lance-shaped leaflets are attractive through the summer. (I have grown Jacob's ladder, too, as a fine house plant.)

At this time the greater celandine *(Chelidonium majus)* is also in flower; and the yellow of its poppy-like flowers is a pleasing color contrast to the blue flower of Jacob's ladder. *C. majus* is excellent for the wild-flower garden, for it has a long flowering period. Its leaf is a beautiful gray-green and deeply lobed. The greater celandine likes sun, but it does grow in shaded woods. This is a naturalized eastern North American plant, having escaped from old gardens. An old saying about this member of the poppy family, taken from a garden book over a hundred years old, is interesting ". . . it beginneth to spring and flower at the coming of the swallow . . . and withereth at their return."

Jack-in-the-pulpit *(Arisaema triphyllum),* a plant that recalls the pleasures of childhood, is a good subject for the native-plant garden. From the moment of its first showing in early spring until fall it is conspicuous because of the hood, or spathe, green more or less striped with purple, that arches over the columnar organ, or spadix, on which are borne the minute flowers. The pistillate or female flowers become brilliant red, fleshy fruits.

Blue chicory *(Cichorium intybus)*

White snakeroot *(Eupatorium rugosum).*

False hellebore *(Veratrum viride)* is a stunning, strong plant with large ribbed leaves that have the odd appearance of being pleated and are most decorative in flower arrangements. The flowers, carried in long branching clusters, are often listed as "green" and are not remarkable, but the foliage alone makes *V. viride* a worth-while addition to the wild garden. It should be noted that the thick rootstocks are very poisonous. This plant is found in moist situations on the eastern shores of our country and will be protected by law when the Cape Cod area is made a National Park.

Two members of the heath family—one trailing arbutus *(Epigaea repens),* protected, but almost too late, the other, wintergreen *(Gaultheria procumbens)*—are very difficult to grow, but it is worth the effort to cater to their requirements. The soil must be acid, sandy, and well drained, yet contain leafmold, and the location must be partially shady. This wintergreen is not to be confused with the flowering wintergreen, or gay-wings *(Polygala paucifolia),* mentioned by Thoreau and still growing at Walden Pond; in fact, it is increasing there. Fortunately, the stand of this interesting native plant is known only to the conservationists who are protecting all the Walden Pond area. Wintergreen *(G. procumbens)* is a very slow grower; in my garden where it has been planted for several years, I see no appreciable growth. Perhaps it is not in the right location.

Trailing arbutus had become rather rare at the time steps were taken to protect it. This native of eastern North America, also called the Mayflower, is said to have been the first flower to greet the Pilgrims—but the fact remains that it has been sadly neglected for far too many years. In early

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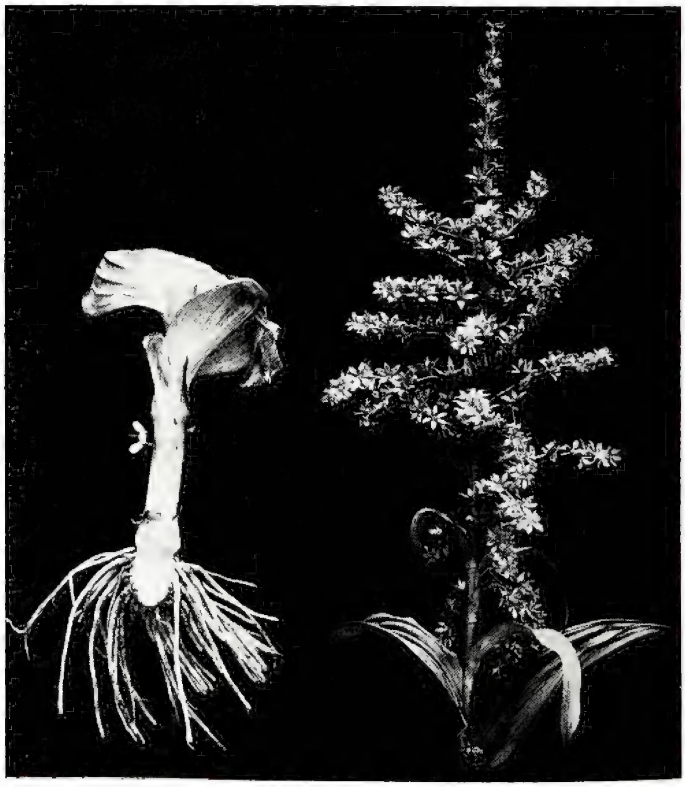
Below. Rootstock and panicle of false hellebore *(Veratrum viride).*

Opposite page. False hellebore grows luxuriantly in this woods in Norwalk, Connecticut.



The old wooden mill, located on the Bronx River and bought in 1792 by Pierre and George Lorillard to be adapted to the manufacture of snuff.

THE LORILLARD SNUFF MILL — AN HISTORIC LANDMARK AT THE GARDEN

Based upon material prepared by Alice Sircom, Staff Associate (Public Relations) of The New York Botanical Garden.

VERY FITTINGLY, an historic landmark of an American industry that manufactures products from a plant stands on the grounds of The New York Botanical Garden, an institution that is dedicated to research and display of plants of the world. The industry, tobacco, uses a tropical American plant, *Nicotiana tabacum.*

In the 1760's, Pierre Lorillard, a young French Huguenot immigrant, had a tobacco "manufactory" on the High Road to Boston, later Chatham Street—now Park Row—in New York City, where he produced and sold products "of the best quality & flavor" from Virginia tobacco.

By the beginning of the eighteenth century, snuffing—and sneezing—had become an international vogue. Although snuff could be made by simply rubbing tobacco over a grater, Pierre Lorillard installed grinding stones which produced snuff of a better quality, and the Lorillard formulas were widely imitated. To keep it fresh, he originated the idea of packaging snuff in animal bladders that had been tanned and dried like parchment.

On May 27, 1789, his elder sons Pierre and George, who inherited the business, ran an advertisement. This showed an Indian holding a pipe and leaning on a hogshead marked "BEST VIRGINIA"; listed tobaccos and snuffs "sold reasonably, and warranted as good as any on the continent." This first known advertisement of America's oldest tobacco company promised "If not found to prove good, any part of it may be returned, if not damaged." The money-back guarantee thus made its appearance on the American business scene.

In 1792, Pierre and George moved their main factory north of the city to the Bronx River where they bought a grist mill, which they adapted to the manufacture of snuff, dam, water rights, buildings, and fifty acres. Later they acquired more acreage. Each mill worker was given a farm on the surrounding wooded property. The Lorillards harnessed the river to run their new mill, and even in the summer drought of 1798 it is reported that eleven and a half million gallons flowed by every twelve hours—nearly forty times the daily amount needed to supply the City of New York at the time.

About 1800 the Lorillards replaced the old wooden mill with a much larger one. The new mill, built of native fieldstone, was located a little farther up the river. Nearby was Pierre's famed "Acre of Roses," for he used roses to perfume the snuff. This mill operated until about 1870, when the family firm moved to a modern factory in Jersey City, New Jersey.

Other tobacco products, including chewing plugs, had replaced snuff by the time Pierre died in 1843. Mayor Philip Hone of New York City noted Pierre's death at the

age of eighty in his diary: "He led people by the nose for the best part of a century and made his enormous fortune by giving them to chew that which they could not swallow."

Around 1856, Pierre Lorillard III built a handsome forty-five-room fieldstone house, gate house, and stable near the mill. The mansion overlooked the Bronx River gorge and falls. The stable had Gothic windows with diamond-shaped panes of glass.

Some time after the firm moved to New Jersey, the family moved to Orange County, and there Pierre Lorillard VI built an elaborate mansion and developed Tuxedo Park.

In 1884, the City of New York acquired over six hundred and fifty acres of the Lorillard property in the Bronx. For a time the residence was used as the 41st Precinct Police Station. Later it was turned over to the Park Department, with the other buildings on the property, and was used as a meeting place and museum for the Bronx Society of Arts and Sciences. The mill was used for a carpentry shop, although the machinery and water wheels were left intact until about 1900.

When the Park Department gave the incorporators of The New York Botanical Garden two hundred and fifty acres of Bronx Park in 1896, the Department retained the Lorillard buildings. Then, in 1915, the Park Department granted The New York Botanical Garden an additional one hundred and forty acres which included the Lorillard buildings, in exchange for land cut off for new parkways.

After renovation of the Lorillard mansion, the Bronx Society of Arts and Sciences continued to use part of it, and the Horticultural Society of New York was given space for offices. The New York Botanical Garden established carpentry, paint, and plumbing shops in the basement and workrooms on the second floor, and furnished a Members' Room. For a time the Garden ran a tea room there.

In mid-morning on March 26, 1923, a fire broke out on the roof of the mansion. Before the fire department arrived, the two upper floors were ablaze. The fire could not be brought under control for many hours, and the ruined mansion had to be razed. Some of the stone and brick were used to build boundary walls, paths, and catch-basins in the Garden.

The mill, known locally as the Old Snuff Mill, was used by the Garden for storage and a carpentry shop. In the

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The fieldstone snuff mill, erected about 1800 by the Lorillards, was restored and opened to the public in 1954 as a restaurant and meeting place.

FLOWERS AND GARDENS IN MADEIRA

By MURRAY WRIGHT, N.D.H.

Mr. Wright, who resides in Allestree, Derby, England, is the holder of the National Diploma of Horticulture from the Royal Horticultural Society; this diploma is granted under an arrangement with the British government.

A view of Funchal Bay, Madeira.

PERHAPS FEW PLACES in the world rival the island of Madeira for floral and scenic beauty. Surrounded by the bluest of sunlighted seas and with a background of great purple mountains, this little island has a perfect setting for its abundance of colorful foliage and blooms.

Bougainvillea in brilliant tones of scarlet, purple, and lilac is suspended from sun-shadowed walls, rambles over trellises and pergolas, clings to trees and houses, and forms incredibly beautiful hedgerows by the wayside. In the spring the dazzling blue-flowered jacaranda trees adorn the streets of the capital city, Funchal; hydrangeas and agapanthus line the country roads; and in shady places the pure white arum-lilies and long-stemmed orchids seem to thrive without attention. In town and country flowers in endless variety bloom throughout the year. How appropriately Madeira has been named *Flor do Oceano* (Flower of the Ocean).

Madeira, an Atlantic island of volcanic origin, has been in the possession of Portugal since 1420. It is situated about three hundred and sixty miles from the coast of northwest Africa and is approximately thirty miles long and twelve miles wide. The center of the island consists of a range of mountains from which deep ravines and valleys extend towards the north and south coasts and in some places the sea. Consequently, while there are many scenes of picturesque grandeur, road-making is often difficult, and certain districts are rather inaccessible. Moreover, as most of the island consists of slopes of varying steepness, a great deal of terracing is necessary for crop cultivation. Commercially the island's farmers concentrate on bananas, sugar cane, and

A February scene in one of the gardens of the Quinta do Palheiro.

grapes; from the latter the famous Madeira wine is made.

The climate of Madeira is mild and equable; in the winter the mean temperature never falls below 55°F. Except in the high mountains, frost and snow are unknown. In the winter there is usually abundant rainfall; up to forty inches have been recorded between November and May. During the summer, however, long dry periods are not uncommon. Throughout the year there are few days without sunshine, and high winds are of rare occurrence. Such climatic conditions, together with a fertile soil, do indeed provide a gardener's paradise.

Botanists believe there is a connection between the original flora of Madeira and that of the West Indies and tropical America. This conclusion is based on the fact that six species of ferns, the lily-of-the-valley tree *(Clethra arborea),* and a tree laurel of the genus *Persea* are all common to the three places mentioned, while none of them is indigenous to Europe or North Africa.

Of course, a great number of plant species have been introduced to Madeira from different countries and diverse climates. So it is that the modest daffodil, primrose, and violet may be found in close proximity to the exotic and flamboyant poinsettia *(Euphorbia pulcherrima)* from Mexico. The flora of the Mediterranean region is particularly well represented.

In this short article it is possible to mention only a few of the decorative plants to be seen in Madeira. In winter the glorious *Bougainvillea spectabilis* takes pride of place. There is also a summer-flowering species, *B. glabra,* which has lilac flowers. *Pyrostegia venusta* (syn. *Bignonia venusta)* is another spectacular winter-flowering vine. This native of South America produces dense clusters of finger-shaped, crimson-orange flowers.

Another outstanding climber of the *Bignoniaceae* frequently seen in Madeira is *Campsis radicans.* The variety *flava,* bright yellow in color, is particularly striking. But the loveliest of all is the bower plant of Australia *(Pandorea jasminoides);* it blooms in May and June. The scarlet passion flower *(Passiflora coccinea)* delights the eye in January and February. The wisterias, successfully grown in less favored climates, reach such a height of perfection in Madeira that they must be mentioned.

The maritime pine *(Pinus pinaster),* a native of the Mediterranean region, has been used extensively to clothe the island's hills and valleys with vegetation. But plants that bear bright flowers call for the greatest attention, and this applies to trees and shrubs. I have mentioned the jacaranda tree which is incredibly beautiful when in bloom. The species usually seen is *J. acutifolia* (syn. *J. mimosifolia).* In the lime-free soil of Madeira camellias thrive abundantly, as do magnolias. *Grevillea robusta* with golden-yellow flowers in summer, is frequently grown. Even more attractive are species of coral-trees, such as *Erythrina corallodendron* and *E. crista-galla,* each bearing large racemes of gorgeous blooms. The beautiful *Wigandia caracabana* (syn. *W. macrophylla)* produces loose flower heads of lilac-purple in winter, and I must not overlook the great white trumpets of *Datura* and the purple blossoms of *Tibouchina semidecandra* (syn. *Lasiandra macrantha).*

There are beautiful gardens in Madeira. An outstanding example is the Quinta do Palheiro, owned since 1885 by an English family named Blandy. The Palheiro garden, situated about five miles from Funchal on the eastern slopes of the Bay and about eighteen hundred feet above sea level, covers approximately thirty acres.

The grounds, which have been beautifully laid out, include two grand avenues of London plane trees *(Platanus acerifolia)* with one hundred trees on either side. It is esti-

Quinta do Palheiro is one of the most beautiful places on the island of Madeira. A rock garden may be seen in the foreground.

Flower girls in national costume sell flowers to tourists in Funchal.

mated that the garden contains ten thousand camellias in both single and double flowers, and in colors of white, pink, red, and purple, also striped and spotted varieties. Some of the camellias reach a height of well over thirty feet and flower continuously between December and May. There are camellia hedges which, in spite of severe pruning, flower profusely. Camellias have been used to line the main entrance to the Quinta. Forms of *C. japonica, C. sasanqua, C. reticulata,* and *C. saluenensis* are the ones mainly cultivated.

Great clumps of magnolias range in height from twenty-five to thirty feet. The species include *M. soulangeana, M. denudata, M. sieboldii, M. sinensis,* and *M. stellata.* The lovely bright yellow mimosas *(Acacia cyanophylla* and *A. decurrens dealbata)* also provide a wonderful picture in winter. Other notable trees at the Palheiro are redwood *(Sequoia sempervirens),* the maidenhair tree *(Ginkgo biloba),* the Norfolk Island pine *(Araucaria excelsa),* the tulip-tree *(Liriodendron tulipifera),* and the camphor tree *(Cinnamomum camphora).*

Several trees indigenous to Madeira are of particular interest to the visitors to this remarkable garden. These are the lily-of-the-valley tree, the dragon tree *(Dracaena draco),* the giant heath *(Erica arborea),* the Madeira holly *(Ilex perado),* and the jasmine-scented *Pittosporum coriaceum.* Large clumps of the brilliant bird of paradise flower *(Strelitzia regina)* and fine specimens of *Gardenia grandiflora* and *Paulownia imperialis* also command attention.

South African bulbous plants are well represented at the Palheiro; among them are nerines, babianas, ixias, sparaxis, and tritonias. Pure white arum-lilies are used most effectively to light up the shady parts of the garden, but it comes as a surprise to see cymbidiums and cypripediums also thriving in the shade. Cymbidiums grow here to a height of six feet.

There is every indication that the people of Madeira appreciate the climatic advantages of their island home. On the less precipitous hillsides thousands of little square houses have been erected, each attractively painted white and standing on its own plot. Each house is nearly always embellished with a vine or creeper-clad trellis, balustrade, or wall. The little gardens are well kept and all year long are bright with blooms.

Typical flowers for these better home gardens are begonias, pelargoniums which often grow into tall bushes, fuchsias, mauve lantanas, scarlet bouvardias, and bulbous plants. Freesias bloom in February and are followed by the brilliant orange tritonias; these in turn are succeeded by lovely blue babianas. In May red amaryllis grow side by side with pale pink *Crinum powellii.*

Perhaps the most popular plant of all for the small garden is the Japanese azalea *(Rhododendron indicum,* syn. *Azalea indica).* Sometimes this is planted in a border, more often it is grown in pots in the tiny courtyard whose pure white walls accentuate the brilliant color of the flowers.

In Funchal the flower girls offer the tourists bunches of arum-lilies, camellias, and long-stalked orchids at astonishingly cheap prices. In the country the children throw floral bouquets into passing cars in the hope of being rewarded with a few escudas. No wonder few leave Madeira without a bunch of the island's flowers.

SOIL pH: WHAT IT IS AND HOW IT AFFECTS SOIL FERTILITY

By ROBERT L. TICKNOR

Dr. Ticknor is Associate Professor of Horticulture at Oregon State University, Aurora, Oregon.

ONE OF THE misunderstood concepts in gardening is soil pH. Technically, pH is defined as a quantitive expression for acidity or alkalinity of a solution, that is, concentration of hydrogen or hydroxyl ions. The scale ranges from 0 to 14, with 7 being neutral, less than 7 being acid, and more than 7 being alkaline. Because pH is on a logarithmic scale, the concentration of hydrogen or hydroxyl ions increases or decreases ten times for each pH unit of change.

From the standpoint of the gardener, it is important that this symbolic number is an index of the suitability of a soil for the growth of plants. Some, such as azaleas, grow best in strongly acid soils near pH 5; others, such as sweet peas, near pH 7, the neutral point. Many plants will grow satisfactorily over a range of pH units, which for acid-tolerant plants could be from pH 4-6 and for many other plants from pH 6-8. Tables of pH preferences of plants appear in several books. One of the most extensive lists appears in *Our Garden Soils* by Charles E. Kellogg (1952).

The growth of plants is affected by soil pH in several ways. Probably the most important way is through the changes in the availability of various nutrient elements in the soil accompanying changes in the soil pH. These changes are illustrated in Figure 25, taken from *Commercial Flower Forcing* by Laurie, Kiplinger and Nelson (1958) and shown here with the permission of the authors and the publishers, McGraw-Hill Book Co., Inc. Calcium is tied up in insoluble forms at low pH, while aluminum and iron become soluble. At quite low soil pH, calcium deficiency and aluminum and iron toxicities can develop. To further complicate the situation, excessive amounts of aluminum and iron in turn can render phosphorus unavailable to plants by forming insoluble compounds with the phosphorus. An application of limestone, which contains calcium, will correct this situation by raising the pH, but the

higher pH may adversely affect some plants. This can be circumvented by an application of gypsum, which will raise the calcium and lower the manganese levels without altering the pH. High pH, brought about in some cases by overliming, reduces the availability of boron, iron, manganese, and phosphorus by causing the formation of insoluble compounds.

Figure 25 shows under average conditions the relationship between pH and the availability of the different nutrient elements. Such soil factors as the type of clay or the amount of organic matter in the soil can make a nutrient element available at a higher or lower pH level than this average. High organic matter reduces the ability of pH to affect the availability of nutrients. Fortunately, because of the limited size of most gardens, it is possible to add sufficient organic matter to the soil to offset unfavorable pH conditions.

Microorganisms react markedly to the pH of the soil. Fungi become the primary agents for the release of nitrogen from the organic matter in the soil in acid soils, while the bacteria that perform this vital task are most abundant in soils approaching neutrality. Below pH 6, the nitrifying bacteria which change ammonia to nitrates show little activity. Such acid-tolerant plants as blueberries and rhododendrons use the ammonia found in acid soils, while many plants can utilize only the nitrates found in soils approaching neutrality. Organisms that fix atmospheric nitrogen do not flourish below pH 5.7.

Earthworms, which require an abundance of calcium, are absent below pH 4.5. They do not live in strongly acid soils because of the low calcium supply. Moles, which feed on earthworms as well as on other soil fauna, are even more sensitive than their food supply to low pH levels, since they are not usually found below pH 5.5. One of the most striking effects of this lack of earthworm activity is the accumulation of a thatch of organic matter on the soil surface.

Two pH determinations of the same soil will not necessarily give the same reading. Readings can differ by as much as a pH unit, depending upon soil conditions. During the growing season the rate of oxidation of organic matter, the rate of uptake of plant nutrients, and the rate of leaching of plant nutrients from the soil will influence the pH of the soil. Soil moisture also influences the pH; a soil becomes more acid as it dries out. This may explain why some crops will tolerate greater acidity in soils that stay moist than in soils that dry out periodically. Even the amount of water used in making the determination can influence the reading.

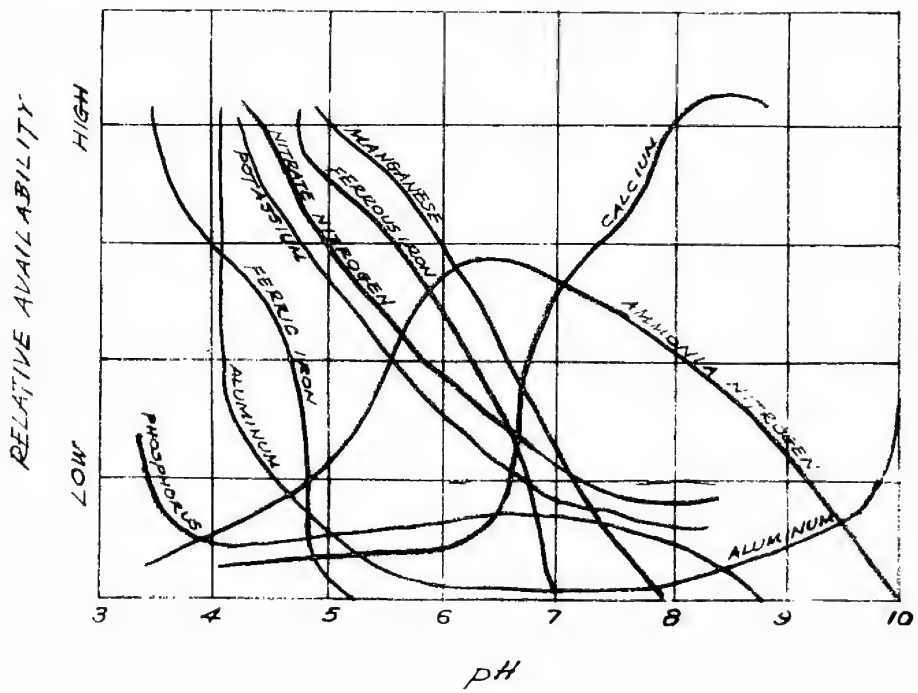

Figure 25 from *Commercial Flower Forcing*, McGraw-Hill Book Co. Inc., 1958.

Several soil conditions influenced by the pH of the soil have been outlined. Fortunately, it is not necessary for those of us who like to grow both acid-tolerant plants and plants that grow best in neutral soils to accept the native pH of our soils. The pH of an acid soil can be raised by the addition of limestone, while sulphur can be used to make an alkaline soil more acid. The amount of either material necessary to bring about the desired soil reaction can best be determined by having your state university's soil-testing laboratory or a commercial laboratory test your soil.

THE LORILLARD SNUFF MILL (Continued from page 219)

early 1950's, Mrs. Harold I. Pratt, a member of the Board of Managers of the Garden, aroused interest in restoring the mill for public use and donated $88,000 for the project. The P. Lorillard Company contributed $25,000, The New York Botanical Garden appropriated $20,000, and The City of New York appropriated the remaining $166,000 for the restoration of the mill as a meeting place and restaurant.

Located on sloping ground adjacent to the Bronx River, the building is two stories high on the upland side and three stories on the river side. The century-old beams were left exposed and show where the machinery for the grinding stones had been attached. These beams now go across the attractive Conference Room on the first floor. The ground floor, or river-side level, was converted into a modern snack bar and cafeteria, and a stone terrace built overlooking the river. The original structure was strengthened but changed little, except for floor-to-ceiling windows and doors in the restaurant and brick buttresses for support and decorative effect between the glass sections.

During the restoration workmen uncovered three millstones that were fifteen feet below the base of the west wall. One was of native New England granite, 47½ inches in diameter, 13 inches thick, with a 10 x 7-inch hole. The

other two seemed to be of volcanic rock and were encased in wrought iron, with two wrought-iron loops attached for the block and tackle. These were of the same diameter as the granite stone, 7 inches thick, with a 9½ x 12-inch hole.

Dr. Brian Mason, Curator of Geology at the American Museum of Natural History, was asked to analyze the volcanic composition. Dr. Mason reported that it was a porous basalt, consisting essentially of the minerals augite and feldspar—a type of rock that appears in many parts of the world, but not in the eastern United States and Canada. As it is not likely that the rock was hauled over the Rockies from California or elsewhere in that region in the mid-nineteenth century, Dr. Mason believes it probably came from southwestern Germany or southern Italy where similar rocks are prevalent. The Lorillards may have had the millstones made in a European quarry, brought by clipper ship to the downtown New York docks, and then hauled to the Bronx by bullock cart.

On April 10, 1954, the restored mill was officially named the Lorillard Snuff Mill and opened to the public. The Conference Room, with kitchen facilities, is used for functions of The New York Botanical Garden and may be rented by other groups and individuals.

The Snuff Mill Restaurant, which is open from the Saturday before Palm Sunday through the Saturday after Thanksgiving, is owned by the Garden, but operated by an outside concessionaire. Operated as a cafeteria, it is open daily between the hours of 10 a.m. to 6 p.m. The dining room is decorated with murals that depict the history of the P. Lorillard Company.

Visitors to the Garden will find tobacco, the tropical American herb that became "big business," growing in the economic plant house of the Conservatory of The New York Botanical Garden.

THE NATURAL SCIENCES (Continued from page 210)

When they returned from their walk, students and teachers although tired, hungry, and with blisters on their feet, had a clearer understanding why so many visit the Trailside Museum. Over a million and a half people have visited the Museum, now in its twentieth year; attendance has risen from less than thirty-five hundred in 1941 to two hundred and seventy-five thousand in 1960. A large share of the credit for this increase belongs to Dr. Moldenke, whose exhibits and talks on the wonders of nature fascinate youth and adult alike. Dr. Moldenke has been Director of the Trailside Museum nine years. He was formerly a member of the staff of The New York Botanical Garden for more than twenty years.

MODERN LILIES (Continued from page 197)

free from disease and thus offer clean material for propagation. Of course, this will not give the bulbs grown from such scales immunity to re-infection; but it would permit growers to produce clean stock, if the plants could be grown in isolation, and to learn just how much influence a virus has in reducing the flowering of many species and hybrids. While seed reproduction often shows that clean strains of a species are much more vigorous, the asexually propagated clones quite often become infected before the clone is disseminated. And, as with the very old hybrid Nankeen lily, *L. testaceum,* there is no way of knowing what a virus-free plant would be like. However, we are warned that this is not a "sure-fire" method of removing virus strains from lilies. Let us hope therefore that the search will go on for a treatment that will do so.

WILD FLOWERS (Continued from page 216)

spring the very fragrant, waxy white or flesh-colored flowers appear above its bright green leaves.

Another flower associated with childhood memories is the Mayapple *(Podophyllum peltatum),* also known as mandrake or Indian apple. It grows in rich woods. Its appearance is intriguing, because the palmately lobed leaves, ten inches or more across, give an umbrella-like effect. The cup-shaped flower is unpleasantly sweet, white and waxlike, and followed by a small yellowish apple. This is edible when fully ripe, but I have never eaten it; when it is not fully ripe, the fruit is considered dangerous. A drug is obtained from the rhizomes.

Virginia cowslip *(Mertensia virginica)* with its drooping funnel-shaped flowers, pink in the bud, opening to blue, and then fading to pink, is easy to grow in cool moist soil in partial shade. Its bluish green leaves disappear not long after the flowers have faded. This "die-back" habit is useful for it makes room for other plants. *M. virginica* seeds easily and may have to be controlled.

Many of the wild flowers that bloom in late summer are rather coarse, large plants and have no place in the small garden; they are better enjoyed where they grow in fields and woods and along country lanes. However, if your wild flower garden is sizeable, then Joe-Pye-weed *(Eupatorium purpureum),* boneset *(E. perfoliatum),* white snakeroot *(E. rugosum)* the goldenrods, ironweed *(Vernonia noveboracensis),* and the asters *(A. cordifolius, A. divaricatus, A. ericoides, A. linariifolius, A. novae-angliae, A. novi-belgii,* and *A. spectabilis)* may be grown. *A. linariifolius* is a very good plant for dry sandy soil; *A. spectabilis* for a moist open site; *A. cordifolius* and *A. divaricatus* for a partly shady spot. *A. novae-angliae* is one of the finest native species and from it, and also from *A. novi-belgii,* many beautiful horticultural forms have been developed.

We must face the fact that many of our wild flowers are being or have been destroyed by heedless picking, careless mowing and spraying, and by the bulldozer used in building roads and houses. If our wild flowers are to be saved, it is our responsibility to do all we can to protect them in nature and to grow them on our properties under the right conditions.

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BRIEF NOTES ON RECENT BOOKS

By ELIZABETH C. HALL

Miss Hall is Sarah Gildersleeve Fife Research Librarian of The New York Botanical Garden

GENERAL GARDENING

THE COMPLETE GUIDE TO GARDEN FLOWERS; AN ENCYCLOPEDIA OF GARDEN PLANNING. Askwith, Herbert, ed. 256 pages, 1,000 color plates. A. S. Barnes and Co., New York. 1961. $12.50.

Here is an answer to the layman's prayer for a one-volume gardening encyclopedia, generously illustrated in full color. Edited under the guidance of an advisory board of eminent horticulturists, this new arrival contains descriptive and cultural notes on more than two thousand plant and gardening subjects. A unique feature is the listing of the approximate retail price of many of the herbaceous plants and bulbs.

THE GARDENER'S REMINDER: A PICTORIAL ENGAGEMENT CALENDAR FOR 1962 WITH WEEK-TO-WEEK SUGGESTIONS. Jenkins, Dorothy. 112 pages, illustrated. Crown Publishers, New York. 1961. Spiral, $1.50.

To enumerate all the high spots of this calendar is just impossible. First of all, there are over fifty magnificent photographs of garden scenes and plants by the "perfectionists" Gottscho-Schleisner. Then, mention should be made of the quaint weather quotations gleaned from American folklore; of the many flower festival and show dates; and of the timely gardening advice (keyed to apply to the six major climatic zones of the United States). A most attractive, informative, and useful booklet.

HORTICULTURAL DICTIONARY IN EIGHT LANGUAGES. Nijdam, J., ed. 504 pages. Interscience Publishers, New York. 1961. $7.50.

This revised and expanded edition of *The Horticultural Word List in Seven Languages*, published by the Ministry of Agriculture and Fisheries in The Netherlands, Horticulture Division, is an "open sesame" for the research worker. Horticultural terms in Dutch, English, French, German, Danish, Swedish, Spanish, and Latin.

OUR GARDEN HERITAGE: ARTICLES FROM THE BULLETINS OF THE GARDEN CLUB OF AMERICA. Anderson, Alice Sloane, ed. 622 pages, 12 color plates, indexed. Dodd, Mead and Co., New York. 1961. $12.50.

A splendid selection of about two hundred papers on gardening and garden plants which have appeared in the *Bulletin of The Garden Club of America* from 1913 to 1958. Among the authors are such widely known horticulturists as Mrs. Francis King, Mrs. Marian C. Coffin, Mrs. Mortimer J. Fox, Mrs. Anna Gilman Hill, Dr. B. Y. Morrison, Dr. Clement G. Bowers, Dr. John C. Wister, Mrs. Louise Beebe Wilder, and Miss Gertrude Jekyll. The reproductions in color are from the works of Redouté, Edwards, Catesby, and Thornton.

PLANT PRUNING IN PICTURES; HOW, WHEN, AND WHERE TO PRUNE, AND WITH WHAT TOOLS. Free, Montague. 286 pages, illustrated, indexed. Doubleday and Co., Garden City, N. Y. 1961. $4.95.

Montague Free, with his rich background of gardening practice and of teaching and writing experience, offers a "visual instruction" volume on the difficult and controversial subject of pruning.

GARDEN PLANTS

CAMPANULAS AND BELLFLOWERS IN CULTIVATION. Crook, H. Clifford. 90 pages, illustrated, indexed. St. Martin's Press, New York. 1961. $2.50.

A popular treatment by the foremost writer on campanulas. Recommended to those gardeners who appreciate the differences between English and American climatic conditions and cultural practices.

THE COMPLETE BOOK OF LILIES. Rockwell, F. F., Esther C. Grayson, and Jan deGraaff. 352 pages, illustrated (part colored), bibliography, indexed. Doubleday and Co., Garden City, N. Y. 1961. $5.95.

The trio who have authored this latest work on lilies is a combination par excellence—Jan deGraaff, President of the Oregon Bulb Farms, with a rich background of experience as a commercial grower and hybridizer; Esther Grayson and Fred Rockwell, distinguished "dirt gardeners," who have previously written many excellent gardening books and have grown successfully countless lilies in their garden in New York and later on Cape Cod. In the present volume, just about everything that pertains to a lily has been discussed and illustrated in detail—the botany, history, culture (greenhouse and out-of-doors), propagation, breeding, exhibiting, judging, flower arrangement, native and foreign species, hybrids, and registration. The appendix has countless lists of lilies for various purposes, such as shade, color, height, and last, but by no means least in usefulness, is the list of over two hundred and fifty plants called "lilies" that are not true lilies.

DAHLIAS. Ogg, Stuart. 123 pages, illustrated, indexed. Penguin Books, Baltimore, Md. 1961. Paper, $1.25.

A Penguin handbook prepared in conjunction and collaboration with the Royal Horticultural Society, and written by a well-known English nurseryman who is Chairman of the National Dahlia Society.

HARDY HEATHS AND SOME OF THEIR NEARER ALLIES. Johnson, A. R. 127 pages, colored front, illustrated, indexed. St. Martin's Press, New York. $2.50.

Another authoritative British text on a fascinating group of plants, not all of which love our American environment. This is a revised edition of an old favorite among English gardeners. The last chapter on the subject of heaths in industry and legend is delightful reading.

THE NEW PERENNIALS PREFERRED. Wilson, Helen Van Pelt. 320 pages, illustrated, indexed. M. Barrows and Co., New York. 1961. $4.95.

Helen Van Pelt Wilson loves perennials, and she writes about them with a contagious enthusiasm. Sixteen years have gone by since her *Perennials Preferred* first appeared. The present volume, written from her Westport, Connecticut, home contains many new ideas and observations as well as numerous planting diagrams, charts, tabulations, and photographs. Of current value is her list of nursery specialists who issue catalogs.

SUCCULENTS IN CULTIVATION (CACTI INCLUDED). Higgins, Vera. 168 pages, illustrated (part colored), indexed. St. Martin's Press, New York. 1961. $4.95.

One of England's experts on succulent plants is the author of this well-illustrated little book. Mrs. Higgins and her husband own an extensive collection of these plants, and they have been growing and observing them for over thirty years. There are good descriptions and specific cultural directions.

VARIEGATED FOLIAGE PLANTS. Fischer, Paul. Transl. and ed. by Corry Van Alphen. 136 pages, illustrated (part colored) St. Martin's Press, New York. 1961. $3.50.

The first book in recent years devoted exclusively to the culture of house and greenhouse plants with variegated foliage. Over one hundred genera are included, and authorities are given for the binomials as well as for most of the varietal names.

HERBS AND FRUITS

CULINARY AND MEDICINAL HERBS, 3rd ed. Ministry of Agriculture Bulletin No. 76. 41 pages. 1960. British Information Services. New York. Paper, 60 cents.

This informative bulletin from overseas deals with the cultivation of about three dozen herbs which are grown for culinary, medicinal, confectionery, and perfumery purposes. The more important commercial crops are given special attention, but the herbs of interest to the home owner are also included.

FRUITS IN THE HOME GARDEN: A HANDBOOK. Slate, George M., guest editor. 96 pages, illustrated. Brooklyn Botanic Garden, Brooklyn, N. Y. 1961. Paper, $1.00.

A concise booklet on the raising of small, bush, and tree fruits and also nuts. Certain sections are devoted to recommendations for specific climatic conditions that are found in our western, prairie, and southern states. Problems of pruning, fertilizing, and pests are expertly handled.

A HERB A WEEK: 1962. Whitman, Helen M., comp. 52 pages. Colored cover. The Tool Shed Herb Nursery, Salem Center, N. Y. 1961. Paper, $1.25.

Delightfully different each year is this herb engagement calendar, with a daily herb-lore quotation from some quaint old text or a timely bid of sound herb-gardening advice.

BOOKS FOR CHRISTMAS

Books are a happy choice for Christmas gifts—a reminder of your thoughtfulness the year round.

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FLOWER ARRANGEMENTS AND FLOWER SHOWS

THE FLOWER ARRANGEMENT CALENDAR: 1962. Wilson, Helen Van Pelt. 110 pages, colored cover, illustrated. M. Barrows and Co., New York. 1961. Spiral, $1.50.

This is the sixteenth annual issue of Mrs. Wilson's popular engagement calendar, well up to the standards set in former years. The flower arrangement photographs come from England, Canada, Australia, Japan, Chile, and from twenty-two of our own states.

GROWING FOR SHOWING. Favretti, Rudy J. 142 pages, colored front, illustrated, indexed. Doubleday and Co., Garden City, N. Y. 1961. $3.95.

Instructions for the would-be exhibitor of prize-winning flowers, fruits, and vegetables by an experienced garden specialist on the staff of the Co-operative Extension Service of the University of Connecticut.

HOURS AND FLOWERS; THE ACCORDION ENGAGEMENT CALENDAR OF JAPANESE FLOWER ARRANGEMENTS. Carr, Rachel E. 102 pages, illustrated (part colored). Charles E. Tuttle Co., Rutland, Vt. 1961. $3.95.

Very Japanese in format and in the covers which are made of Japanese silk. It opens and shuts in an accordion-like manner. About fifty photographs of Japanese arrangements are accompanied with analytical captions. Quite charming.

A TEACHER'S GUIDE TO FLOWER ARRANGEMENT. Fox, Raymond T. 40 pages, illustrated. Kenneth Post Foundation, Ithaca, N. Y. 1960. Paper, gratis.

Six lesson-plans for teaching the principles of elementary flower arrangement are made available by the Kenneth Post Foundation as a contribution to youth education in floriculture.

BIOGRAPHY, HISTORY, AND TRAVEL

COLONIAL WILLIAMSBURG: ITS BUILDINGS AND GARDENS: A DESCRIPTIVE TOUR OF THE RESTORED CAPITAL OF THE BRITISH COLONY OF VIRGINIA, rev. ed. Kocher, A. Lawrence and Howard Dearstyne. 104 pages, illustrated, bibliography, indexed. Holt, Rinehart and Winston, New York. 1961. $3.95.

Written by two widely known architects who were formerly associated with Colonial Williamsburg. The fine photographs represent the collective work of talented experts.

DISCOVERY: GREAT MOMENTS IN THE LIVES OF OUTSTANDING NATURALISTS. Terres, John K., ed. 338 pages, J. B. Lippincott Co., Philadelphia. 1961. $6.50.

John Terres, formerly editor of *Audubon Magazine,* has brought forth a collection of the most extraordinary accounts of adventures and experiences by contemporary naturalists, here and abroad. Thirty-six internationally famous wild-life travelers and explorers (one of whom is a woman) have each (in response to Mr. Terres' request) written of a memorable experience that is linked with the discovery of something new to natural hitsory.

THE DRAGON TREE: A LIFE OF ALEXANDER, BARON VON HUMBOLDT. Gendron, Val. 214 pages, illustrated, bibliography, indexed. Longmans, Green and Co., New York. 1961. $3.95.

A fine, inspiring, and exciting biography of a dynamic scientist, explorer, and statesman.

THE EXPLORATION OF THE COLORADO RIVER. Powell, John Wesley. 176 pages, illustrated, indexed. (The Natural History Library) Doubleday and Co., Garden City, N. Y. Paper, 95 cents.

One of the great figures in the opening of the American West was Major Powell, who in 1887 succeeded Clarence King as director of the U. S. Geological Survey and was also director of the Bureau of Ethnology from its inception until his death in 1902.

FOREST VENTURE: CONQUERING THE DESERTS OF THE MIDDLE EAST. Maitland, Louise G. 192 pages, illustrated, indexed. International Publications Service, New York. 1960. $4.50.

Observations of the wife of a British forester, who accompanied her husband on a tour of the Middle East and northern Africa—Lebanon, Cyprus, Syria, Iran, Algiers, Morocco, and Egypt.

JOHN AND WILLIAM BARTRAM'S AMERICA: SELECTIONS FROM THE WRITINGS OF THE EARLY AMERICAN NATURALISTS. Cruickshank, Helen G., ed. 378 pages, illustrated, indexed. (The Natural History Library) Doubleday and Co., Garden City, N. Y. 1961. Paper, $1.45.

Helen Cruickshank's editing and biographical introduction are well done. Particularly useful is the inclusion of valid scientific names of plants and animals with the Bartrams' eighteenth-century nomenclature.

JOHN BURROUGHS' AMERICA: SELECTIONS FROM THE WRITINGS OF THE HUDSON RIVER NATURALIST. Wiley, Farida E., ed. 293 pages, illustrated, bibliography, indexed. (The Natural History Library) Doubleday and Co., Garden City, N. Y. Paper $1.45.

To have known John Burroughs and his beloved "Slabsides" was Farida Wiley's good fortune. Her introduction and editing show a wonderful understanding of a unique figure. Delightful reading for nature lovers.

JOURNAL OF A RESIDENCE ON A GEORGIAN PLANTATION IN 1838-1839. Kemble, Frances Anne: edited and introduction by John A. Scott. 415 pages, illustrated, bibliography, indexed. Alfred A. Knopf, New York. 1961. $5.75.

Thanks to the perseverance of an ardent lover of historical source material, John A. Scott, Head of the History Department of the Fieldston School in Riverdale, New York, there has been republished an almost forgotten, famous pre-Civil War diary of a leading English actress who married a wealthy cotton and rice planter. Mr. Scott's documented introduction is a scholarly contribution.

JUST ABOUT EVERYTHING IN THE ADIRONDACKS. White, William Chapman. 101 pages, illustrated. The Adirondack Museum, Blue Mountain Lake, N. Y. 1960. Paper, $3.50.

A choice selection of the nature writings of the late William Chapman White. Much of this material appeared in the columns of *The New York Times* and *The New York Herald Tribune.*

THE MOUNTAINS OF CALIFORNIA. Muir, John. 300 pages, illustrated, indexed. (The Natural History Library) Doubleday and Co., Garden City, N. Y. 1961. Paper, $1.25.

A paperback reissue of John Muir's first book that appeared in 1894 and played an important role in the battle for conservation.

NATURE'S YEAR: THE SEASONS OF CAPE COD. Hay, John. 199 pages, illustrated. Doubleday and Co., Garden City, N. Y. $4.50.

Poetic prose by the talented president of the Cape Cod Junior Museum. Illustrated with delightful woodcuts by David Grose.

PILGRIMAGE FOR PLANTS. Kingdon-Ward, Frank. 191 pages, illustrated, bibliography, indexed. George G. Harrap and Co., London. 1960. $2.75.

Observations on plants and plant collecting by the late Kingdon-Ward, one of England's great plant explorers. William T. Stearn of the Department of Botany of the British Museum (Natural History) has written a splendid biographical introduction and has compiled the lengthy list of Kingdon-Ward's publications.

THE OCEAN ISLAND (INAGUA). Klingel, Gilbert C. 415 pages, illustrated. (The Natural History Library) Doubleday and Co., Garden City, N. Y. 1961. Paper, $1.45.

A reissue of the popular account of two wild-life expeditions to the lonely island of Inagua in the Bahamas. Mr. Klingel is the author of *The Bay,* which won for him the John Burroughs Medal for excellence in nature writing. writing.

THE PACIFIC ISLANDS, rev. ed. Oliver, Douglas L. 456 pages, illustrated, bibliography, indexed. (The Natural History Library) Doubleday and Co., Garden City, N. Y. Paper, $1.45.

The Curator of Oceanic Ethnology at Harvard University paints a vivid picture of the life and customs of the peoples of Micronesia, Melanesia, and Polynesia. Of particular interest are the parts dealing with such economic plant products as sugar, coffee, coconut, sandalwood, and pineapple.

REDWOOD POEMS; MOODS AND SCENES FROM THE LAND OF GREEN GIANTS. Coblentz, Stanton A. 80 pages. Naturegraph Co., Healdsburg, Cal. 1961. Paper, $1.50; cloth, $2.50.

A selection from previously published books of Stanton Coblentz. Not only does the poet sing of the sequoias, but also of the plants and animals which form the ecological background of the redwoods.

SHEARWATERS. Lockley, R. M. 256 pages, indexed. (The Natural History Library) Doubleday and Co., Garden City, N. Y. 1961. Paper, $1.25.

This book about birds has running through it valuable observations on the plants and terrain with which the birds are associated. The shearwaters breed on islands off the Welsh coast and migrate to sunny lands near the shores of Portugal.

WHITE WATERS AND BLACK. MacCreagh, Gordon. 335 pages, illustrated. (The Natural History Library) Doubleday and Co., Garden City, N. Y. 1961. Paper, $1.45.

One of the most readable and amusing accounts ever written on exploration in the wild jungles of South America. Long out-of-print, its appearance in a paperback should charm old and new readers alike. Dr. James A. Oliver, Director of The American Museum of Natural History, suggests in the Forword that this be "required reading" for armchair travelers as well as for "sweat and toil" trippers.

WILDERNESS: THE DISCOVERY OF A CONTINENT OF WONDER. Platt, Rutherford. 310 pages, illustrated, indexed. Dodd, Mead and Co., New York. 1961. $6.00.

A dramatic, informative story of three hundred years of exploration in America from coast to coast, by one of the popular nature writers and photographers. Mr. Platt has been a member of The New York Botanical Garden for many years.

FOR YOUNGER READERS

LOUIS AGASSIZ: ADVENTUROUS SCIENTIST. Tharp, Louise Hall. 200 pages, illustrated, indexed. Little, Brown and Co., Boston. 1961. $3.75.

Mrs. Tharp gained great fame with one of her adult books, *The Peabody Sisters*. She has made a study of New England's notables and now presents a lively biography of Agassiz for teen-agers.

MORE RESEARCH IDEAS FOR YOUNG SCIENTISTS. Barr, George. 158 pages, illustrated, bibliography, indexed. Whittlesey House, McGraw-Hill Book Co., New York. 1961. $3.00.

Another welcome title from the author of *Young Scientist Takes a Walk, Young Scientist Takes a Ride*, and *Research Ideas for Young Scientists*. "Are Only the North Sides of Trees Green?"; "How Do Dandelions Ruin Lawns?" —all sorts of fascinating problems to solve.

MUIR OF THE MOUNTAINS. Douglas, William O. 183 pages, illustrated, indexed. Houghton Mifflin Co., Boston. 1961. Paper, $1.95; cloth, $2.80.

A Supreme Court Judge, who is also one of our country's great conservation disciples, has written a fine biography of the "Father of our National Parks," for teen-agers.

MY HOME IN THE ZOO. Iles, Gerald. 239 pages, illustrated. Doubleday and Co., Garden City, N. Y. 1961. $4.50.

There is never a dull moment in life at the zoo, according to Gerald Miles who has spent his adult years in close contact with "wild" animals in captivity. Fairfield Osborn, President of the New York Zoological Society, has written a glowing introduction.

1001 QUESTIONS ANSWERED ABOUT THE SEASHORE. Berrill, N. J. and Jacquelyn Berrill. 305 pages, illustrated, bibliography, indexed. Grosset and Dunlap, New York, 1961. Paper, $1.75.

Which of the following belong to the plant world: sea anemones, sea grapes, mermaid's cup, periwinkle, sea cucumbers, sea lettuce, sea pansy, sea peach? Be careful, it's a catch question, but the answer is in this fascinating quiz book.

SCIENCE BOOK-LAB OF SEEDS. Selsam, Millicent E. 46 pages, illustrated. (Basic Books Science Book-Lab Series). Science Materials Center, New York. $3.95.

"Do-It-Yourself" kits combine fun and learning. This kit consists of a well-illustrated book of instructions and explanations, a planter with lid and water-tray, vermiculite, fertilizer-tablets, magnifying glass, labels, two plastic vials, and seeds of radish, mung beans, peas, peanuts, and lima beans. Millicent Selsam is recognized as one of the leading teacher-trained science writers for young people.

THE FIRST BOOK OF WILD FLOWERS. Cavanna, Betty. 68 pages, illustrated, bibliography, indexed. Franklin Watts, New York. 1961. $1.95.

Another of "The First Book Series" with especially fine text, format, and illustrations. There are intriguing headings such as "Plants That Set Traps," "Wild Flower Plants That Are Good To Eat," "Amusing Wild Flower Nicknames," and "How to Start a Wild Flower Garden."

THE HOW AND WHY WONDER BOOK OF THE MICROSCOPE AND WHAT YOU SEE. Keen, Martin. 48 pages, illustrated (part colored). Grosset and Dunlap, New York. 1961. $1.00.

A thrilling introduction to the workings of a simple and compound microscope with very fine illustrations. Clear instructions are given for the staining of slides, drop mounts, the growing of molds, and so forth.

TRAILS OF HIS OWN: THE STORY OF JOHN MUIR AND HIS FIGHT TO SAVE OUR NATIONAL PARKS. Grossman, Adrienne and Valerie Beardwood. 206 pages, illustrated, bibliography. Longmans, Green and Co., New York. 1961. $3.95.

A fictionalized biography that will hold the interest of a young reader and will instill a love for the great California country of John Muir.

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WONDERS OF OUR NATIONAL PARKS. Thomson, Peter. 63 pages, illustrated, indexed. Dodd, Mead and Co., New York. 1961. $3.00.

Here is the twenty-fourth title in the excellent "Wonder Book Series" for pre-teen readers. The author grew up in Yosemite National Park, where his father was superintendent.

WONDERS OF THE WORLD BETWEEN THE TIDES. Wakeman, Norman H. 63 pages, illustrated, indexed. Dodd, Mead and Co., New York. 1961. $2.95.

The photographer of some of the thrilling Disney Nature Films has written and illustrated this attractive text for young naturalists. He and his family are ardent seashore enthusiasts.

SOUTHERN CALIFORNIA GARDENS. Padilla, Victoria. 359 pages, illustrated, indexed. University of California Press, Berkeley, 4, California. 1961. $10.00.

This is a book every garden-minded visitor and resident in southern California should own. It is an encyclopedia of gardens, gardeners, and plants of the region. The book shows Miss Padilla to have had experience in writing. She is a member of the English faculty of Los Angeles College and has a literary style pleasant to read.

She tells how many different plants were grown in California before 1800. Much was brought from Spain, but many plants came from South America and the Pacific Islands.

(Continued on page 232)

NEWS, NOTES and COMMENTS

A Systematic Border is being established at The New York Botanical Garden to show examples of plant families as well as the arrangement in order of the families by botanists. It follows the general order of Engler and Prantl, which is widely used throughout the world by botanists.

The border, approximately six hundred feet long, is divided into thirty-nine beds and at the present time contains over four hundred plants illustrating seventy-seven families. The beds, which start with the grass family, *Graminae*, and proceed to the composite family, *Compositae*, demonstrate the evolution of plants from those that have an extremely simple flower to those that have a flower of highly complicated structure.

The plantings will be augmented as plants become available. In the main, annuals and perennials will be used, but it may be necessary to plant out some tropical species during summer to represent a particular family.

The systematic border is being developed to acquaint the public with the different plant families and to show them representative members of these families. Some visitors were amazed this past summer to learn that the weed *Galinsoga ciliata*, which they pull out of their flower borders, is a relative of the chrysanthemum, which they strive to cultivate to perfection. Both are *Compositae*. Other visitors were no less surprised to learn that the star-of-Bethlehem *(Ornithologalum umbellatum)*, which spreads so much that it is regarded as a "nuisance" plant, is a relative of the lovely Solomon's seal *(Polygonatum commutatum)*, which is frequently grown in the native plant garden, and of the beautiful yellow day-lily *(Hemerocallis flava)*. These last three plants are members of the lily family, *Liliaceae*.

T. H. Everett, Assistant Director (Horticulture) and Senior Curator of Education, and Louis P. Politi, Horticulturist, are responsible for the systematic border. It should prove to be an educational asset of The New York Botanical Garden not only in its service to the public, but also to the more serious student of plants.

Children's Gardencraft Class. Graduation exercises were held in the Recreational Hall of Bedford Park Presbyterian Church, New York City, on August 26, 1961, at which certificates and prizes were presented. Lillian Weber, the Garden's instructor, spoke of the work and showed slides of the children's gardens. Howard W. Swift, Assistant Curator of Education, informed the large audience of parents and friends of the fund for book prizes that has been created by Mrs. Herman M. Kurtz in memory of her brother, Dr. Jacob Schnur. Dr. Schnur, a physician who practiced in the Bronx, enjoyed walking daily through The New York Botanical Garden. Mrs. Hiram McCann, a past director of the Ninth District of the Federated Garden Clubs of New York State, Inc., presented books to the following: Beginners—girls, first, Laura Fennell, second, Linda Kwartler, third, Irma Haas and Linda Watanabe; Beginners—boys, first, Michael Weinstein, second, Michael O'Leary, third, Daniel Dunning; Advanced—first, Paula Matheson, second, Patricia Mullaney, third, Leonard Feigenbaum; Monitors—Lenore Wile and Kenneth Foley.

Elizabeth C. Hall, Sarah Gildersleve Fife Research Librarian, talked to the children on "Taming Wild Vegetables—From the Caveman Down Through the Centuries." She told them that all our tame or cultivated vegetables have come from wild or native plants, which once grew in the fields before man became civilized. Our carrots first came from Afghanistan; later the Romans and Greeks grew carrots and fed them to their horses to make their coats glossy. The Pilgrims brought lettuce seed to America when they came on the "Mayflower." Lettuce still grows wild along the shores of the Mediterranean. Spinach came from Persia; but it, too, found its way to America. Today, down in Texas, spinach is grown and shipped in carload lots all over the United States. Crystal City, Texas, is called the spinach capital of the world; right in the middle of the city is a large statue of "Popeye the Sailor," who taught boys and girls to eat spinach every day so that they would be strong and healthy. From Africa came the watermelon, and many a traveller has been saved from dying of thirst by the juicy watermelon which grows wild in arid regions of Africa. Leeks were first found in western Asia, but they finally reached England and Wales. In a battle between the Welshmen and the Saxons, so the story goes, St. David told the Welsh captain to order each Welshman to put a leek in his hat so that he could recognize his own countryman. The Welsh won the battle and ever since that time the national plant of Wales has been the beloved leek.

"What did Columbus find when he landed in 1492 in America?" Miss Hall queried, and answered, "Vegetables that were very strange to him—potatoes, tomatoes, peppers, pumpkins, squash, lima beans, peanuts, and corn—all grown by the Indians. When Columbus went back to Europe, he took seeds from these American vegetables with him. Soon his countrymen learned to eat them and found them very good.

"Today, we are living in a wonderful world. Scientists are discovering how to breed bigger and better fruits and vegetables. We enjoy seedless watermelons, seedless grapes, seedless grapefruits and oranges, stringless beans, and jumbo peanuts. It's fun to read the stories about our vegetables and fruits. If you are curious to learn

Representative members of the *Compositae* in the systematic border of The New York Botanical Garden.

more about the plants that you grow and eat, visit the Library of The New York Botanical Garden. A corner in the Library is reserved for boys and girls, and there you will find books with pictures and exciting stories of wild and tame plants."

The Dahlia Display at The New York Botanical Garden again served as the Eastern Trial Grounds for The American Dahlia Society with fifty-one new entries and eleven re-entries from last year. Judges of the Society visited the planting on several occasions to rate the dahlias. They commented favorably on the excellent care they were receiving under the direction of Louis P. Politi, Horticulturist.

In addition to these dahlias, approximately ninety other varieties were grown; these ranged from tiny pompons to large formal decoratives measuring twelve to fourteen inches across.

The display was scheduled to be at its peak the weekend of September 23, 1961; unfortunately, hurricane "Esther" the night of September 20 played havoc with this large crescent-shaped border. The plants staged a recovery and were fine in late October.

Gifts to the Garden. The Malba Garden Club, in appreciation of the information and assistance made available to it through the courtesy of Miss Hall, Dr. Rickett, Mr. Politi, and other members of the Garden's staff have contributed $25.00 to the Library Fund. The Morristown Garden Club also contributed $25.00 to this fund.

Mr. and Mrs. John E. Lockwood contributed $5,000.00 to the Native-Plant Garden, and the Advisory Council a like amount.

$11,200 have been received for the Garden's Endowment Fund from the estate of Mary Thurston Cockcroft.

Activities of the Director and Staff. Within the past few months, Dr. William C. Steere, Director, attended a luncheon and meeting, in New York City, of the Cultural Institutions Group; gave a lecture before the Garden Club of Mt. Vernon, New York; attended a meeting in Albany, New York, of the Council of the New York State Association of Museums, a meeting in New York City of State Education Commissioner Allen's Committee on Museum Resources, a meeting in Washington, D. C., of the evaluating committee of life sciences of the National Academy of Sciences—National Research Council to evaluate National Science Foundation postdoctoral fellowships; addressed the first meeting in the fall of the Volunteer Associates of The New York Botanical Garden; attended the dedication ceremonies, in Pittsburgh, of the Rachael McMasters Miller Hunt Botanical Library, the annual meeting, in Philadelphia, of the Board of Trustees of *Biological Abstracts*, a meeting in Washington, D. C., of the executive committee of the A.I.B.S. Biological Sciences Communications Project, and the annual meeting of the New York State Association of Museums at Cooperstown, New York; and addressed the sixteenth annual American Horticultural Congress at Northampton, Massachusetts, on the subject of "Science Lends a Hand to the Busy Gardener."

T. H. Everett, Assistant Director (Horticulture) and Senior Curator of Education, addressed the Advisory Council at its meeting on October 26, 1961, held at the Snuff Mill.

Howard Swift, Assistant Curator of Education, visited Michigan State University and the Beal Botanic Garden at East Lansing, Michigan. The latter, which is fairly extensive, has a good arrangement of plants by families in a natural planting.

Louis P. Politi, Horticulturist, judged the flower shows of the Pegasus Garden Club of Socony Mobile Oil and the Maiden Lane Garden Club of the Home Life Insurance Co.

Dr. David J. Rogers, Curator of Economic Botany, enjoyed a "busman's holiday" during his vacation. He visited several places near Asheville, North Carolina, where fine furniture is made, to learn more about the present sources of supply for hardwood and what is being done about hardwood reforestation.

Dr. Marjorie Anchel, Senior Research Associate, and Dr. George Bistis, who formerly worked in our Research Laboratory and returned in September, as Research Associate, to collaborate with Dr. Anchel, have received grants from the National Institutes of Health. Dr. Anchel's grant is entitled "Unusual Fungal Products; their chemistry and relation to biological problems." Dr. Bistis has received two grants: the one to enable him to collaborate with Dr. Anchel, entitled "Genetics of Biochemical Variations in Basidiomycetes"; the other for his own research, entitled "Compatibility Locus in *Ascobolus stercocarius*." Dr. Bistis is replacing Dr. Nalini N. Valanju, Research Associate, who left to join the staff of the Institute of Muscular Diseases, affiliated with Rockefeller Institute, in New York City.

Vincent Ravachieri of Iona College has replaced Bernard Russ who left the Research Laboratory, where he had been employed since January, 1956, to work with Ciba Pharmaceuticals, Inc., Summit, New Jersey.

Susan Canham came to the Garden in September, 1961, as a graduate assistant in the Cryptogamic Herbarium under Dr. Clark T. Rogerson, Curator of Cryptogamic Botany. Mrs. Canham is working toward her Ph. D. at Columbia University.

Elizabeth C. Hall, Sarah Gildersleeve Research Librarian, lectured on herbs and their uses at Sunlight House in Egypt, Massachusetts, under the sponsorship of the New England Unit of the Herb Society of America and the Green Thumb Garden Club. Miss Hall was interviewed for a broadcast on a weekly garden program in Providence, R. I., sponsored by the Rhode Island Federation of Garden Clubs. While in Providence, Miss Hall visited several libraries including the John Carter Brown Library, famous for its rich Americana collection. Miss Hall attended the dedication ceremonies of the Rachel McMasters Miller Hunt Botanical Library in Pittsburgh, as did Mrs. Hermann G. Place, a Vice President of The New York Botanical Garden, Dr. Harold W. Rickett, Bibliographer and Senior Curator of the Library, and Dorothy E. Hansell, Editor of *The Garden Journal*.

Mrs. Hansell judged flower shows of the Passaic Township (New Jersey) Grange 181 and the Royal Liverpool Insurance Group, and the dahlia show sponsored by the New Jersey Dahlia Society and the American Dahlia Society. She

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attended a meeting of Region 19 of the American Iris Society held at Rutgers University, the conference of the Central Atlantic Region of the National Conference of State Garden Clubs held at Atlantic City, the sixteenth annual American Horticultural Congress held at Northhampton, Massachusetts.

Charles C. Clare Jr., Staff Artist, spent his summer vacation on a farm in Ashfield, Massachusetts. He devoted much of his time to making line drawings for a book on trees for students up to high-school age. The book, entitled *The Study of Trees Made Simple*, by Solveig Russell, is one of the "Made Simple Series" published by Doubleday & Co., and is expected to be available in the fall of 1962.

The National Trust for Historic Preservation met in New York City on October 13-16, 1961. Among the places visited was the Lorillard Snuff Mill at The New York Botanical Garden. Mrs. Hermann G. Place was Chairman of the New York Committee for the 1961 meeting.

Visitors to the Garden.

Prof. Richard M. Straw, Department of Biology, Los Angeles State College, Calif.

F. Bruce Lamb, U. S. Plywood Corp., New York, N. Y.

Dr. William Crotty, Department of Biology, New York University, New York, N. Y.

Dr. Mehmeh H. Kayacick, on a tour arranged by U.S.D. A. Foreign Agricultural Service Training Division.

Ludwig H. van Kanten, Department of Economic Affairs, Paramairibo, Surinam.

Rev. Luis J. Archer, S. J., Department of Botany, Instituto nun Alvers Caldas de Saude (Minko), Portugal.

Dr. Herman Wister, Plant Pathologist, National Capital Parks, Washington, D. C.

Dr. H. Bentley Glass, Johns Hopkins University, Baltimore, Md.

Dr. Mehmet Oner, University of Atatürk, Erzurum, Turkey.

Vyi Moosad, University of Wisconsin, Madison, Wisc.

Dr. Floyd L. Brown, Austin Peay State College, Clarksville, Tenn.

Dr. Hans E. Green, Farlow Herbarium, Harvard University, Cambridge, Mass.

Dr. Norman V. Rothwell, Long Island University, Brooklyn, N. Y.

Alma T. Walker, Athens, Georgia.

Claire Berg, Botany Department, University of Chicago, Ill.

Dr. Sydney Smith, St. Catherine's College, Cambridge, England.

Mrs. Arthur M. Anderson, who had been a member of the Corporation of The New York Botanical Garden since January 9, 1933, died on August 27, 1961. Mrs. Anderson was also a member of the Advisory Council from February, 1931.

Thomas Reynolds died on August 19, 1961, at the age of seventy-eight. He had served the Garden for thirty-five years. Mr. Reynolds, a foreman at the Power House, was given sick leave from December 26, 1960 until May 1, 1961; then was on terminal leave at the time of his death.

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Dr. Walter A. Egler, Director of the Museu Paraense Emilio Goeldi, Belém, Brazil, died by drowning on the Museu's, the Instituto Agronomico do Norte's, and The New York Botanical Garden's expedition in Amapa, Brazil, led by Dr. Egler and Dr. Howard S. Irwin of the Botanical Garden. Dr. Egler lost his life when his canoe was swept over a waterfall the fore part of September, 1961.

Fortunato Zandegiocomo died suddenly at the age of seventy-two years. He had served the Garden as a skilled carpenter and loyal employee for twenty-six years, and was pensioned in November 1960.

Robert B. Clark assumed the duties of Assistant Director of the Bayard Cutting Arboretum, Oakdale, Long Island, on September 15, 1961. He had previously been Assistant Professor of Ornamental Horticulture in the College of Agriculture, Rutgers University, The State University of New Jersey.

Robert A. Bartlett has been elected President of the Bartlett Tree Experts, succeeding Orville W. Spicer, who retired in September, 1961, after twenty-four years as president and forty-six years of service with the Bartlett company.

Mr. Bartlett in 1937 joined the Bartlett firm, which was founded by Dr. F. A. Bartlett, now chairman of the board. He was elected vice president in 1950 and executive vice president in 1954.

Mr. Bartlett attended Syracuse University and Columbia University, and at one time was with the Forest Pathology Department of the United States Department of Agriculture at Yale University. He is a member of the National Shade Tree Conference, the Northeast Weed Control Conference, the Virginia Public Utility Brush Control Conference, the Connecticut Tree Protective Association, the New Jersey Federation of Shade Tree Commissions, and the New York Arborists Association.

Mr. Spicer is co-author of the revised Spicer-Felt formula for shade-tree evaluation and is also widely known as an author and lecturer on shade-tree care. For years he served on the advisory and executive committees of the National Shade Tree Conference and has been identified with many horticultural and tree protective organizations.

A Day at Fordhook Farms. Mr. and Mrs. David Burpee entertained members of the horticultural press and other horticulturists from New York, Philadelphia, and Washington, D. C., at Fordhook Farms in Doylestown, Pennsylvania, on August 24, 1961. The original part of their beautiful home was built sometime between 1750 and 1780. Close by is the old icehouse and just beyond, nestled against the sloping ground, is the old springhouse. In front of the original entrance are two broad-spreading lindens which cast welcome shade on the stone terrace. One of these is considered to be the largest linden in the state of Pennsylvania. Mr. and Mrs. Burpee share a deep interest in trees, and many magnificent specimens grace Fordhook Farms. A majestic white pine has been named "Old Warrior"; its asymmetrical contour is proof that it has weathered many storms.

Mr. Burpee's father, W. Atlee Burpee, bought the property in 1876 and started the trial grounds in 1888, a year after he had etsablished the W. Atlee Burpee Co. David learned the seed business under his father. He left Cornell University as a freshman in 1913 to help with the family business because of his father's serious illness. At his father's death in 1915, David assumed charge of the firm; it was incorporated two years later. He has since served as president and general manager.

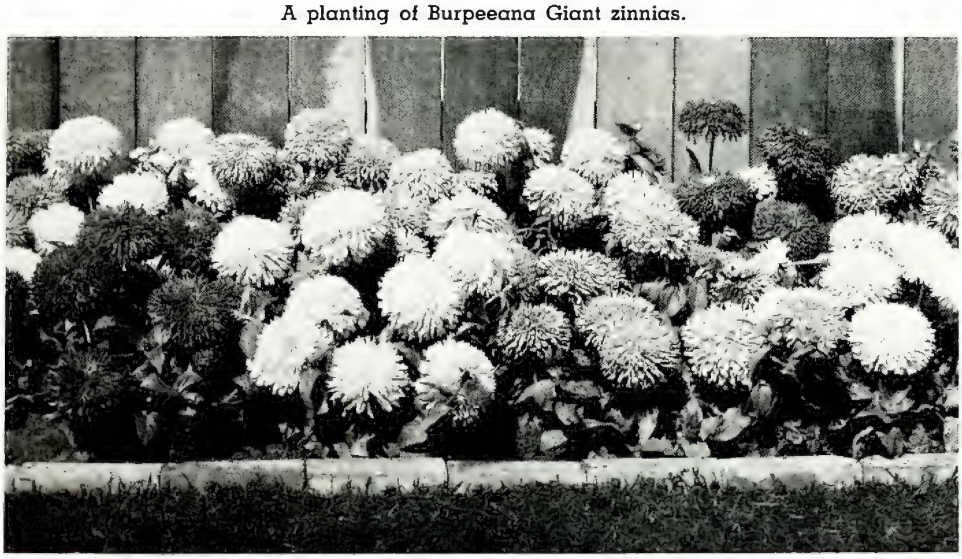
Aster 'Radiance'.

Mr. Burpee briefed his guests on some of the research work for and development of better strains of annuals and vegetables that have been carried on at the W. Atlee Burpee Co. farms at Lompoc and Santa Paula, California, and at Fordhook Farms. The seeds are raised in California, since the climatic conditions there are more favorable to large-scale seed production than are conditions in the East. Extensive experimental grounds are maintained at Fordhook Farms, as also at Lompoc and Santa Paula. A tour was made of these grounds, where the visitors saw some of the Burpee introductions for 1962. They also saw the trials of All-America Selections which are conducted at Fordhook Farms.

Highlights of the 1962 flower novelties in our opinion were aster 'Radiance' which produces semi-quilled flowers of scarlet-rose, as much as four and a half inches across, on sturdy, two-foot-tall plants; marigold 'Primrose Climax', an American F_1 hybrid, which bears its fully double, globular flowers of a cool primrose-yellow from midsummer till frost; snapdragons 'Glacier' with strong spikes of large florets on a base-branching plant, and 'Super-Jet', an F_1 hybrid, with double, frilled, clear yellow florets on tapered spikes; and zinnia 'Red Man', one of the Burpeeana Giants. These zinnias, bearing large terminal flowers on short, stocky plants, have been developed especially for today's low or one-story houses. The ruffled and quilled flowers of the Burpeeana Giants come in white through yellow, pink, red, violet, and purple. In 1951, one of the Burpee staff horticulturists noticed some plants that were considerably shorter than average in rows of hybrid zinnias. He covered these plants with mesh to keep the bees away, and later they were hand-pollinated. The plants raised from the resulting seeds were "screened out" each year until the desired type was obtained.

Dorothy Ebel Hansell, Editor of *The Garden Journal,* and Howard Swift, Assistant Curator of Education, represented The New York Botanical Garden.

A planting of Burpeeana Giant zinnias.



Torrey Botanical Club, Fall-Winter 1961 Program. On October 7, 1961, a combined field trip and meeting was held at The New York Botanical Garden. Anne Seaman led the group through the Thompson Memorial Rock Garden, Dr. Annette Hervey on a tour of the Research Laboratory, and Elizabeth C. Hall on a tour of the Library. After a buffet supper in the Seminar Room in the Laboratory Building, the members related their summer experiences.

On October 17, 1961, Dr. James Gunckel of Rutgers University lectured on "Tumor Formation in a Tobacco Hybrid: Cytological, Morphological, and Physiological Aspects." On November 7, 1961, Dr. Martin H. Zimmerman, of the Maria Moors Cabot Foundation for Botanical Research at Harvard University, spoke on "Structure of Tree Bark and the Transport of Organic Substances."

Charles H. Callinson of the Audubon Society will discuss "The Battle for Wilderness Preservation" on November 21, 1961, at Columbia University; Dr. Elsa H. J. O'Donnell, Visiting Research Associate of The New York Botanical Garden, "Nucleolar Structure" at Fordham University on December 5, 1961; Dr. Seymour Hutner, Director of Haskins Laboratories, "Growing Photosynthesis Bacteria," at Columbia University on December 19, 1961.

At the annual dinner and meeting, to be held in the Men's Faculty Club of Columbia University on January 16, 1962, Dr. William C. Steere, Director of The New York Botanical Garden, will deliver his presidential address. His subject will be "Bryophytes in Experimental Research."

The Litchfield Hills Audubon Society has recently published a brochure on *Herbicides, 60 Questions and Answers concerning Roadside and Right of Way Vegetation Management.* The questions and answers cover General Importance; Engineering Requirements; Botanical Technology; Commercial Technique; Conservation, Health, and Landscaping. The brochure was prepared by Dr. Frank E. Egler. Copies may be obtained at twenty-five cents each, or one hundred copies for twenty dollars, from the Service Department, National Audubon Society, 1130 Fifth Avenue, New York 28, N. Y.

BOOK REVIEWS (Continued from page 227)

We are also told about herbs and herb gardens, and the many nurseries from 1850 to the present time are described. There are also biographies of the numerous gardeners who owned and operated the nurseries and of others who planted fine gardens, and the plants each one introduced are described. As might be expected, many of the gardeners were born and trained in England.

Miss Padilla does not confine herself to introduced plants, but gives an enthusiastic account of the California natives.

There is also a chapter on the development of the flower-seed industry, which is conducted as scientifically as a factory wherein aeroplanes or missile weapons are being manufactured.

The last chapter tells about botanical gardens and is inspiring to those of us who are interested in similar local institutions.

The illustrations are not artistic, but serve to clarify the story. There is an excellent bibliography.

HELEN M. FOX
Mt. Kisco, New York

CHARLES DARWIN. Wichler, Gerhard. 228 pages, 24 plates, indexed. Pergamon Press, New York. 1961. $6.50.

Although the acknowledged purpose of this well-documented book is to demonstrate that we owe to Charles Darwin alone the positive proof of his theories of descent and natural selection, Professor Doctor Wichler has given us as an added bonus an accurate picture of science in general during Darwin's era and the historical background leading to the theory of evolution in particular. Carefully and dispassionately, he has assembled as evidence excerpts from Darwin's voluminous correspondence and publications that present a fair, unbiased account of Darwin as a scientist, the various stages in the development of his theories, and their reception by his contemporaries. An index of names and another of subject matter facilitate the use of the book material.

Dr. Wichler has brought out, too, many subordinate factors that he considers significant contributions to Darwin's achievements: happiness in home and family, despite chronic illness; freedom from all financial worries; the blessing of friendship and cooperation of the great scientists of the day, not all of whom were in accord with his theories of descent and selection. We are given brief sketches of these several contemporaries and the important part played by each in bringing Darwin's researches to a conclusion.

From all of this there emerges, in addition, the portrait of a great thinker, at once modest and humble, frequently distrustful of his own ideas, but always sincere in his search for truth. This book is a definite contribution towards a more thorough understanding of Darwin and his theory of evolution, not only by the student of science, but the lay reader as well.

CAROLINE K. ALLEN

ROADSIDE FLOWERS OF TEXAS. Wills, Mary Motz. Text by Howard S. Irwin. 295 pages, illustrated, indexed. University of Texas Press, Austin, Texas. 1961. $5.75.

Mary Motz Wills has been painting the flora of Texas for over fifty years, and this volume brings together two hundred and seventy-five reproductions of her delightful water colors of the more common wild flowers the average person might encounter along the roadsides.

The botanical text is written by Howard S. Irwin, formerly on the staff of the Botany Department of the University of Texas, now at The New York Botanical Garden. He gives short descriptions, Latin and common names, and distribution of the plants portrayed and references to related species. The indexed map of the counties of Texas might be of assistance for locating plants of limited range.

The plates occupy the first part of the volume. They are arranged in systematic order and the amateur will find them easy to use as the numbers of the plates appear prominently in the text.

This book could be a helpful companion for anyone who is unfamiliar with Texas plants and planning a motor trip through this section of the country.

LYNETTE L. SCRIBNER

THE PHYSIOLOGY OF PLANTS. Quer, Font P. 126 pages. Illustrated. Harper and Bros. New York. 1960. $2.25.

Professor Quer, former director of the Barcelona Botanical Institute, has written an elementary "Science Today" book on plant physiology for the grammar school child. It is cleverly written and illustrated and can be unhesitatingly recommended.

RICHARD M. KLEIN

LETTERS TO THE EDITOR

Sorry I was unable to obtain a good photograph of loquat *(Eriobotrya japonica)* in my shrub border before the deadline for the September-October issue. However, as it is a nice specimen, I am sending the photo anyway. Perhaps readers of *The Garden Journal* may be interested in seeing how well this shrub from China and Japan grows in my garden. It is grown in California, Florida, and similar frost-free regions for its acid fruits that are used in preserves and pies.

Loquat *(Eriobotrya japonica).*

JUNE RAINSFORD HENDERSON
Aiken, South Carolina

The September-October 1960 issue of *The Garden Journal* carried an article by Dr. Seymour Shapiro on "Radiation: An Aid in Plant Improvement."

In connection with this article, I thought your readers might be interested to learn what has been done here at Holden Arbortum with the decorative European alder, *Alnus glutinosa.* This tree, unfortunately, is very susceptible to leaf miner which results in brown blistery leaves and reduces its value as an ornamental. The Arboretum had several thousand dormant seeds bombarded with cobalt-60 gamma rays—a dose of 16,000 r., in November 1957. Many failed to germinate, a few survived but were chlorotic and lived just a short time. Only one seedling of all the progeny appeared to be different from the original species. We assumed that the irradiation causd the curious change and brought about a new form of *A. glutinosa.*

(Continued on Inside Back Cover)

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DOROTHY EBEL HANSELL
Editor

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This cultivar appears to be immune to the pests that plague the species. The leaves are concave, glossy, deep green, and of a leathery texture. What the ultimate height of this tree will be we do not yet know.

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Holden Arboretum anticipates further experiments with radiation in its search for improvements in other selected trees.

LEWIS F. LIPP, Horticulturist
Holden Arboretum
Mentor, Ohio

We wish three extra copies of the July-August issue of *The Garden Journal* for our executive committee.

We are most happy to learn from this issue that The New York Botanical Garden is to have its own Native-Plant Garden. I hope those responsible for its development will feel free to call on us, if we may help in any way. We have been at it for twenty-seven years, and we can tell any one a great deal about what *not to do!* Sometimes that is valuable, too.

MRS. LYNWOOD R. HOLMES, Chairman
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